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Editor

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False Notions About Germany and the Dawes Plan

SOME chemical manufacturers, judging from our contact with a number of them, seem to be obsessed with the fear that the adoption of the Dawes plan and the rehabilitation of Germany mean the speedy annihilation of our chemical industry. They look for an immediate flood of cheap German goods—potash, dyes and chemical manufactures. And there is further apprehension in some quarters based on the belief that an American loan to Germany at this time will result in a new period of inflation in the United States. Neither of these views, we contend, is in keeping with the best economic judgment of the day.

In the first place, German recovery at best will be a slow process. It is not to be expected that over night she will seize command of the world's markets and set things at sixes and sevens. The establishment of sound currency and financial conditions in Germany under the Dawes plan and the gradual return of more normal trade relations will without doubt increase Germany's productivity enormously—but it will require time. German recovery will be of much more direct economic significance to France and England than to this country. These countries can hope to secure reparation payments roughly in proportion to their willingness to admit German exports to the foreign markets. They must choose which horse they will ride. Adjustments in the United States will be comparatively slight and certainly they will be gradual.

The notion that American participation in a loan to Germany will lead to tremendous inflation in this country is preposterous. There is much more danger, the economists tell us, in our present swollen gold reserve. The most useful and least dangerous thing that can be done with our surplus gold is to provide external loans that will assist the European countries back to a gold basis. The money markets are now unusually easy. The rediscount rate of the Federal Reserve Bank of New York was lowered in August to 3 per cent. Commercial paper has been selling in recent weeks at the lowest rates since 1916. A foreign loan at this juncture, far from causing inflation, may be expected to have exactly the opposite effect.

The proposed 800 million gold mark loan is to provide the basis for the new German gold note bank. The significant point is that we lend money to Germany. The Dawes report says that "in the interest of currency stability, and to aid the successful inauguration of the new bank, the proceeds of the loan should be used exclusively for financing internal payments, such as deliveries in kind, whether direct or by the operation of the reparation recovery act, and that part of the costs of the armies of occupation which represents expenditures in Germany, by or on behalf of the armies." Would the withdrawal of $200,000,000 from our resources to be devoted to the purposes indicated cause inflation in this country? We are certain that it would not. On the other hand American industry —the chemical manufacturer included—will ultimately be benefited by the general improvement in Europe that will follow the gradual rehabilitation of Germany.

What Should We Pay For a Cord of Wood?

ALTHOUGH the industries producing wood pulp consume only a relatively small fraction of our annual wood and timber cut, still the matter of true raw material cost is of as vital importance to them as to larger associated industries. It is unfortunate that from the beginning of forest utilization in this country our tree resources have been considered as a mine rather than as a crop. With a total annual cut of nearly 23 billion cubic feet and an annual loss through fire, insects, disease, etc., of more than 2 billion cubic feet, we are using our forests fully four times as fast as replacement is taking place. When it is considered that the net cost of delivering this timber at the mill is generally reckoned on the cost of cutting and transportation alone, one senses the unsound basis upon which the wood products industry has been operating.

This holds especially true in the case of the pulp industry. Spruce that cost $4.95 per cord in 1899 costs about $23 at present. This appreciation, however, cannot be accounted for on the ground that the item of replacement is now figured into the cost, as certainly should be the case. Actually, receding forests and higher labor costs account very largely for this rise in price.

There is no doubt that the time has come when we must regard our forests as a crop—a crop requiring at least 40 to 50 years to reach sufficient maturity to make cutting practicable. Hazards due to fire, to fungus, to insects, to damaging storms, are never absent. At best an acre of reforested land can produce hardly more than half a cord of wood per year. Therefore the actual cost of production is far different from the figure that has been complacently accepted since the early days. Although it is true that we do not have the data necessary to provide a sound basis for arriving at the true cost of growing wood, for the simple reason that we have not progressed to the point where the first crops planted are ready to cut, still it is possible to make a fair approximation on the known cost of land, of planting seedlings, of supervision, of cutting and transportation with suitable deduc-

tions for the natural hazards that cannot be eliminated. We shall do well to figure the cost of pulp production, of timber and wood chemicals on such a basis. Until we do, we are neglecting a consideration that otherwise will one day assert itself with such force that these industries will find themselves in a most embarrassing position.

Discrimination Against Synthetic Foodstuffs

THERE is a saying that if you give an unprincipled person enough rope he will eventually hang himself. Thus the dairy industry, flushed with the success of unfair and discriminatory legislation in its favor, is increasing its demand for special consideration to an extent that only serves to emphasize the injustice of its attitude toward other industries the products of which may be sold at a lower cost to the ultimate consumer. Voters in Oregon were recently asked to support a measure by which "it shall be unlawful for any person . . . to manufacture for sale, sell or exchange or expose or offer for sale or exchange any substance containing any milk or milk product and designed or intended to be used, or capable of being used, for or as a substitute for butter, which contains any vegetable fat."

If the sale of any healthful, pure-food product is made unlawful, in order to bolster the trade in another food product, it is clear that we have reached the parting of the ways; and it must be recognized that our actions are to be controlled by laws passed at the dictation of and through the influence of self-interested groups, clearly not for the benefit of the nation or of the community as a whole. The Oregon proposal is as absurd as it is unfair. Who is to decide what is or is not a substitute for "butter," a word for the use of which the dairy industry has no exclusive monopoly? As a change from the inevitable bread and butter, the housewife may decide to use the flour in another manner and to get the necessary fat from cacao butter, a constituent of chocolate, of unquestioned food value. She may make a layer cake using chocolate containing evaporated milk and the natural (cacao) vegetable fat. In this instance the chocolate is certainly capable of being used as a substitute for butter. It contains a milk product and a vegetable fat. Therefore, according to those who are trying to tamper with the laws of Oregon, all manufacturers and sellers of chocolate should go out of business, in deference to the wishes of the dairy industry.

The sale of oleomargarine is hampered enough as it is, in spite of the fact that, considering the price of dairy butter, it is a necessary food product for a large proportion of the population. The name alone is a deterrent to its use; manufacturers would do well to co-operate in the interests of the industry and evolve an alternative designation. The laws against coloring and sale are discriminatory and unfair, especially when it is realized that manufacturers of dairy butter are allowed free rein in this respect. In all seriousness, legislation can go no further in an attempt to kill an industry that complies with all requirements as to quality and purity of a product that meets a popular demand and supplies a definite necessary of everyday life.

Chemical Engineering In the Home

OCCASIONALLY we are reminded that chemical engineering, like charity, might well be practiced at home to an extent that would relieve the housewife and the cook of many of the problems that formerly worried the plant manager. The thought is suggested by the lack of efficient utensils for the filtration of fruit juices and the clarification of coffee, soup, near beer, fruit beverages and other things too numerous to mention.

Those who have watched the usual kitchen procedure of filtering fruit pulp in a suspended bag in order to obtain a clear liquid for the making of jelly must have realized what a mess, waste of time and material are involved, and how unsatisfactory is the result. Filter aids are almost unknown in domestic economy. Gravity is relied upon to effect the filtration despite the fact that suction is easily available at or near every kitchen faucet. We have been told that a small filtration apparatus for home use has been marketed, but diligent inquiry has failed to trace its origin or place of manufacture. In any event there is opportunity for exploitation in this direction, aided possibly by inventive effort. Manufacturers of filter aids should make a market for their articles in small-packet form, at a price that would appeal to the housewife as an insignificant expenditure in comparison with the ultimate economy of time, raw materials and labor insured by everyday use. The creation of a demand for home consumption should encourage economies in production, and ultimately reduce costs of similar material to the chemical industries. To make the plan effective, however, it is essential that the housewife can purchase a complete filter outfit at a reasonable price, to consist of a vessel with false bottom to carry the filter and provided with an aspirator for connection to the faucet to aid filtration by artificial suction. The market for such a kitchen adjunct should be large, both here and abroad. Familiarity with modern filtration methods should pave the way toward the introduction of other modified forms of chemical engineering apparatus in the kitchen.

The Technologist as a Factor In Commercial Expansion

COMMENDABLE enterprise on the part of the Los Angeles Chamber of Commerce is evidenced by the recent publication of a map on which is shown the distribution of metals and minerals in the seventeen counties comprising southern California. Among others we note antimony, asbestos, asphalt, barytes, borax, clay, coal, copper, chrome ore, fullers earth, gas, gold, gems, gypsum, diatomite, iron ore, limestone, magnesite, manganese ore, marble, mica, nitrates, oil, quicksilver ore, quartz, sandstone, salt, silver ore, soda, sulphur compounds, talc, soapstone, and tin, tungsten and zinc ores. The map was prepared to show at a glance the availability of raw material, as a part of a so-called balanced-prosperity campaign—an effort to keep industrial expansion in line with population growth. Surveys have been made by engineers, and reports have been written, which are placed in the hands of commercial concerns, actual and prospective, that may be interested in sharing in the expansion of the district. Statistics of industrial growth indicate the

success of this scheme, which should be followed by all organizations of a similar nature.

Next to the availability of data of this character, it must be realized that industrial pioneers require an intelligent survey of possibilities, not only in connection with raw material but in regard to markets for byproducts as well as for major products. A chamber of commerce of a growing community would do well to employ on its regular staff a chemical engineer of broad experience, to correlate reports of reserves, to investigate the possibilities in the development of new industrial fields and to summarize the advantages of new plants in the utilization of the most up-to-date equipment and practice.

Through all the technical industries—and these form the backbone of commerce—runs a similarity in fundamentals, a similarity that can be recognized only by the experienced technologist. A study of processing or manufacturing methods at several different plants in any given locality will convince an investigator of the lack of means for the intercommunication of ideas. A practice in one plant will remain standard for many years after a more efficient or more economical method has been developed and proved in another industry, perhaps alongside. An unrecognized market for products and byproducts often exists, the details of which are available only after adequate investigation and research. Individual enterprises have recognized the value of the technologist in plant operation. The time is ripe for collective business, as exemplified by the chambers of commerce of growing industrial communities, to utilize the services of technologists that have the experience and ability to co-ordinate individual technical efforts and to place at the disposal of those interested a scientific survey of possibilities, based on actual fact and legitimately anticipated prospect. This offers the best insurance against business depression in any industrial community.

Chemical Engineering Fables—The Graphite Method in the Plant

AT COLLEGE there was always a certain percentage of the class in quantitative analysis that used the well-known graphite method on every problem. The graphite method consists of taking a reliable MH pencil, figuring out what the results should be and then, *mirabile dictu,* obtaining precisely those results. Theoretically it never injured anyone except the offender, but practically it injured many people, often years after.

In a sulphuric acid plant a dozen to a hundred samples are received every day. If the laboratory reports anything unusual, there descend upon the laboratory various disgruntled plant men, who express their opinion of the laboratory, its methods, its ability and its utility. After several such experiences even George Washington would probably have realized that nine times out of ten the sample was at fault and a little tactful deceit would save a great deal of trouble. Perhaps the graphite method may be exonerated in such an instance. There it is the system that is at fault.

But here is another instance. An earnest chemical engineer is making a plant investigation. He must have some analyses made and he asks if the laboratory can make them. Yes, says the laboratory head without much enthusiasm. His force is overtaxed anyway, and every department kicks against the charges for routine analyses. The assistant superintendent who supervises the laboratory also assents, but with bad grace, for the chemical engineer isn't very popular with him. The samples come in. The laboratory gets into a jam and the following conversation takes place:

Assistant Superintendent: "What's the reason for the delay on these analyses?"

Chief Chemist: "Well, for one thing there are those samples from the chemical engineer that we had to do."

Assistant Superintendent: "Can't you guess at them?"

Chief Chemist: "Why, yes, I guess so!"

Assistant Superintendent: "Well, don't waste any time on that stuff if you can dope them out."

No, that is not an editorial fiction. It is a composite of several conversations within our experience. And so it comes to pass that the chemical engineer's results are graphite method results and they may not point in the right direction. Our chemical engineer failed on a job and was fired because of human cussedness and graphite results. There ought to be a moral to this. If there is, we hope it does not involve doing your own analytical work. On the other hand, sampling and analytical work are often important and neglected links in the chain of investigation. Perhaps we might conclude by remarking cryptically, "A word to the wise is sufficient."

The Properties That Are "Hardness"

IT WAS mentioned in these columns not long ago that the word "hardness" applied to a metal means so many things that it means nothing in particular. The "hardness number" obtained by any given hardness testing machine is the resultant of several fundamental properties. The working property that we wish to measure is also the resultant of several such fundamental properties. It now appears that two of these fundamental factors have been isolated.

A paper by Dr. Samuel L. Hoyt before the A.S.S.T. convention in Boston described in detail a method devised by Prof. Eugene Meyer of the Technischen Hochschule at Charlottenburg for analyzing the familiar Brinell hardness test into two figures that are measures of two fundamental properties of the metal tested. Since a metal hardens to a variable extent when subjected to cold work (permanent deformation by a load), its "hardness" varies as work is done upon it and no one figure can be used to give a true picture of the metal's resistance to penetration. A combination of two figures will give this picture, if one of the figures measures the initial resistance to deformation and the other measures the ability of the metal to be hardened by cold work. By making a series of Brinell or other ball indentation tests on a specimen, data are obtained that make it possible to calculate these two figures.

By the use of these factors two dissimilar metals can be directly compared in regard to their suitability for certain purposes. Other immediate applications of the work of Professor Meyer and Doctor Hoyt will be apparent to the metallurgist, but the great value of their work, it seems to us, lies in the fact that the first two of the fundamental factors of "hardness" have been caught and tamed. When we have a few more, the riddle of hardness will have disappeared.

Science and Art

These pictures and those appearing on subsequent pages tell an interesting story. Of course, they show the steps in the production of vitrified wheels from the raw materials, but they show more than that. Each reveals the art that has had to be employed along with science or rather by science in bringing about successful production. Many of the illustrations show clearly the great manual skill that is necessary in some of the processes, and these same processes are designed and controlled by scientific methods perfected by scientific research.

So often a mistaken conception of science in industry is emphasized—a conception of science sweeping away manual dexterity and substituting the machine for the worker. Often this is possible and desirable. The point that is often missed is that science does not disregard the art of the past. It is an invaluable tool to be superseded only by a revolutionary development.

Perhaps the two pictures to the left show this as perfectly as any. They illustrate steps in the wet or puddling process of mixing the ingredients for vitrified abrasive wheels. The kettles are shown clearly in the upper picture. In these the watery mixture is stirred for a long time—stirred in such way that not only is complete mixing effected but entrained air is largely eliminated. Now enter the art. The workmen ladle the mixture out into paper-lined molds and then the last traces of air must be eliminated from the mixture by working it up and down with the ladle. It is an art that had to be developed to insure uniformity and lack of flaws in the individual wheels. It was developed as a final refinement by the engineers in charge of the work.

Below are two photographs showing the method of trimming green wheels to approximate size before burning. This is more essential in the case of puddled wheels, which deteriorate on the surface as they dry, than in the case of dry-pressed wheels.

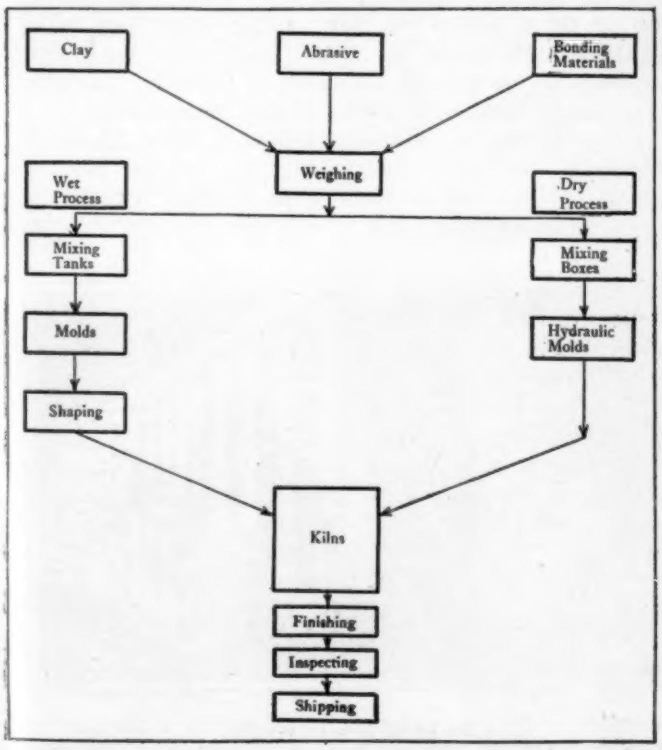
Making Vitrified Abrasive Wheels

From Carborundum Grains to Abrasive Wheels Is an Arduous Path—Some of the Problems of Interest to Engineers Are Recorded in This Article

PRODUCTION grinding is a term that has been coined but recently. It means that machine parts can be ground automatically with sufficient accuracy to be used in machines without further processing. In many ways this is the most important single factor in the production of cheap automobiles, that marvel of organized civilization. But this advance would have been impossible with the natural abrasives that were known 25 years ago and therefore in a sense it is a chemical engineering advance made possible by the production of such abrasives as carborundum.

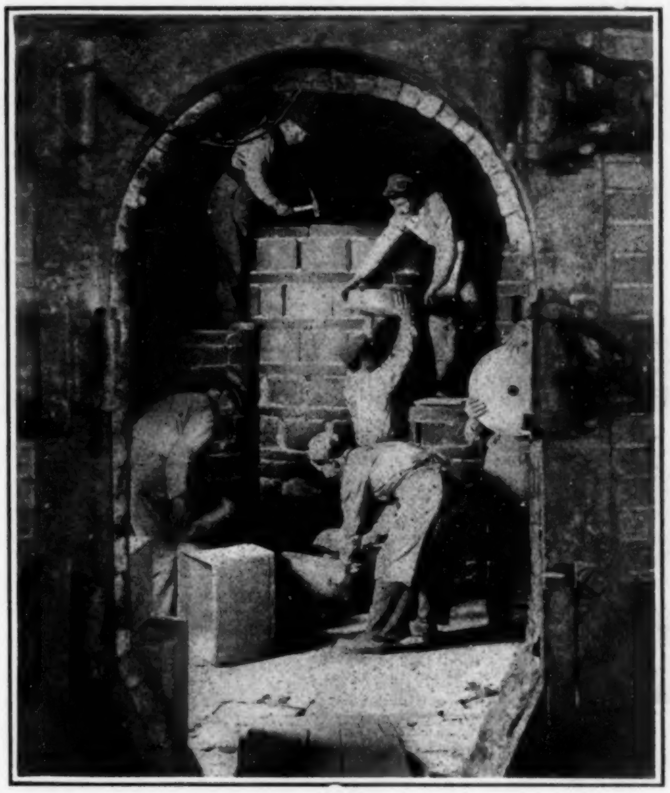
There is one more vital step that must be mentioned in the development of production grinding as a commercial possibility. Without the abrasives it would have been impossible, without ingenious machines it would have been out of the question, but unless the abrasives had been made into convenient and reproducible wheels and other shapes, we should still be dreaming of cheap automobiles.

Back of the production of abrasive wheels from the grains lies a vast amount of careful effort. The processes do not show such spectacular applications of power as does the production of abrasive grains themselves described in an earlier article (*Chem. & Met.*, Sept. 29, 1924). But many difficult and perplexing problems had to be solved before the industry reached its present efficient condition—problems that involved almost endless experimentation. Proper bonding materials had to be developed, the temperatures at which they mature had to be ascertained; the effect produced by varying amounts of them on the abrasive particle produced had to be determined; and, most important, the methods of insuring uniform duplicable quality had to be worked out.



Flow Sheet Showing the Processes That Contribute to the Manufacture of Vitrified Wheels

In the earlier article we discussed the production of twenty-one different carefully graded carborundum grains. Grading is made on a basis of the number of spaces per linear inch of screen through which a given particle will pass. The following grains (or "grits," as they are called) are stocked: 4, 6, 8, 12, 16, 20, 24, 30, 36, 40, 50, 60, 70, 80, 90, 100, 120, 130, 150, 170, 200 and also F, FF, FFF and "minute" powders.



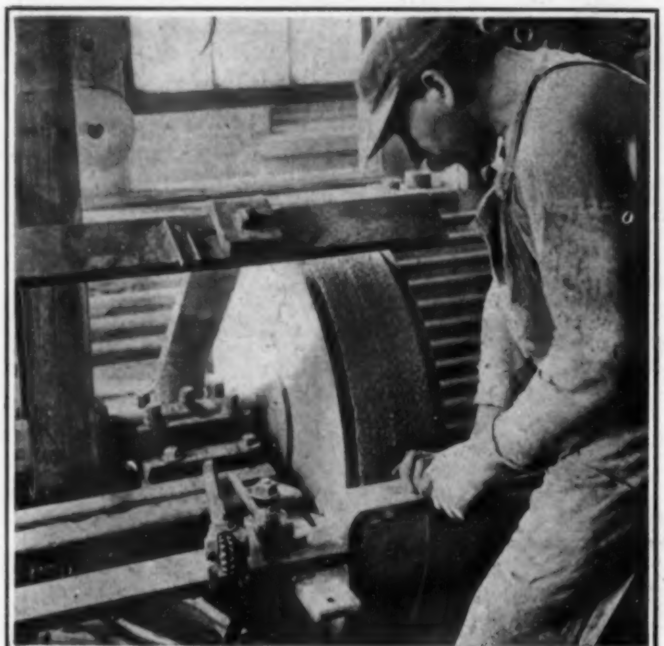
Loading the Kiln for Firing
The photograph illustrates well the method of piling as well as the way in which saggers are built up section by section

This "raw material" is used to make up wheels (or stones) that contain either a single size of grit or two or even more sizes, so that a large number of combinations is possible. But the situation becomes more complicated when it is realized that many different kinds of wheels can be made from the same size abrasive grain. The hardness of the wheels will vary with the kind and amount of bonding materials used, a high percentage of bonding material giving a

hard wheel. By varying the kind of material used in the bond the structure of the wheel varies greatly, and such classifications as close tough and open tough are obtained. A great many varieties are made "special" to fit specific grinding conditions. Finally, the size and shape of the wheel can be and are varied extensively. These facts indicate why it is impossible to stock many varieties of wheels and why the production is, so to speak, made to order.

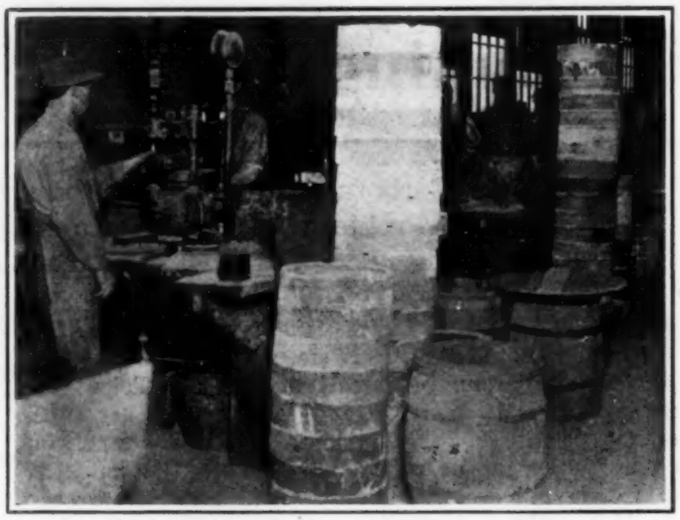
There are two general methods of making wheels—the wet or puddling process and the dry-press process. In neither case has it been found desirable to mix batches containing more than 700 lb. of material at one time, for in the puddling process tiny air bubbles cannot easily be worked out of larger batches, and in the dry-press process the abrasive particles do not get an even coating of bonding material. The size of the mix will vary from 100 to 700 lb.

In the dry-press process the ingredients are introduced into small tumbling barrels that are turned until the coating of the abrasive particles with bonding materials is adequate, usually for several hours. Water is then added until the mixture has the general consistency of molding sand. It is evenly distributed in a steel mold of appropriate size and shape and subjected to hydraulic pressure. The molds closely approximate the ultimate size of the wheel, although frequently special shapes are cut from the pressed "blank" on a rotating table. The wheels are then dried at 150 deg. F. for several days before burning.



Dressing the Wheels
One of the final processes in making vitrified ware. After being burned it is ground to size with great care. Note the star-toothed dressers used in grinding resting on the guard

The puddling process requires a mixing in hemispherical tubs, with enough water to make a thin paste. The stirrer is designed not only to accomplish complete mixing but to eliminate air bubbles that might prove disastrous in the finished product. Water is added slowly and stirring continued for many hours. The mixture is finally transferred to metal ring molds supported on plaster "batts" and lined with heavy paper. In these molds the mixture is worked by hand or "spooned" to eliminate the last traces of air. This process requires great manual skill and two workers may produce very different results from the same mix. After a few hours, during which the wheel "sets," it is dried as is the dry-pressed wheel.



Hydraulic Press Used in the Dry-Press Process
This particular press is used for small wheels or stones

To get good vitrified wheels heat must be applied at a definite rate, uniformly, and to a definite maximum intensity. Control is essential; uniform heating is essential. To carry out these exacting demands the design of the kiln, the method of placing the ware in the kiln and the method of firing must be taken into account. The kiln is coal fired with down-draft and the hot gases filter down through the piles of saggers (fireclay containers in which the ware is placed) in an evenly distributed course.

To load the kiln the ware is placed on fireclay plates and segments of fireclay are built up in the form of a ring around each piece of ware or sometimes around two or three pieces together. Other containers luted together with strips of "wad" clay (like macaroni) are built up on top till a "stack" is formed. The kiln is gradually filled with stacks of like construction.

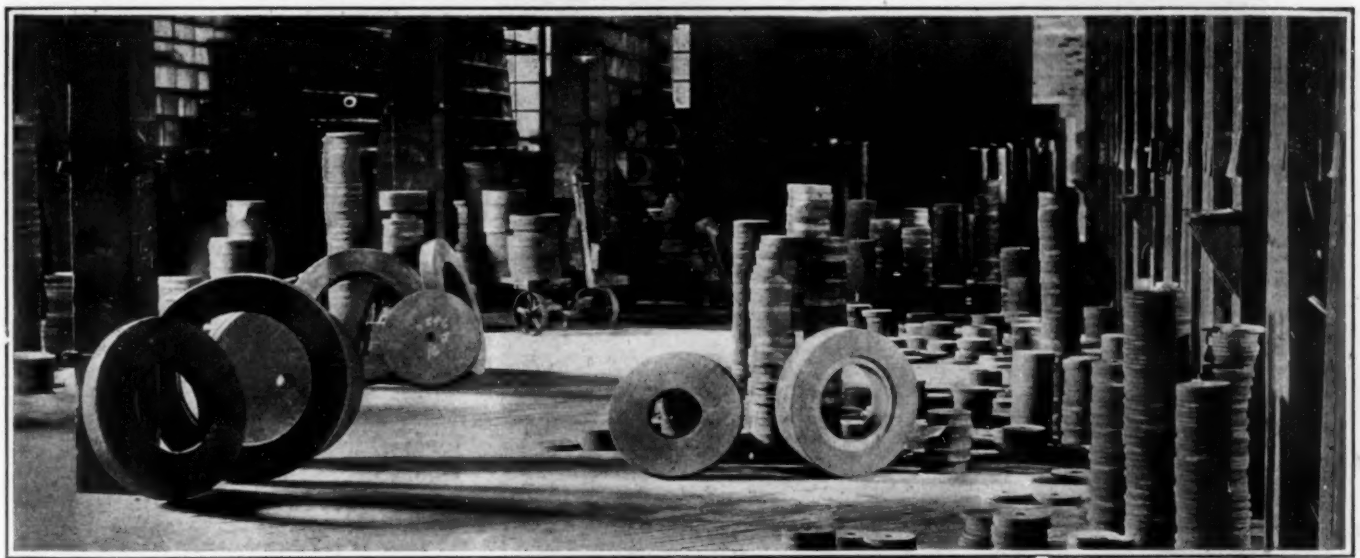
Temperature is carefully followed with Leeds & Northrup recorders throughout the entire heating period, the final temperature being checked with Orton cones. The burning cycle of any kiln usually occupies

Racks of Master Wheels
These master wheels form an important link in the testing process. Careful tests are made to determine the toughness and grit of the new wheels in comparison with the approved standard of the same formula

2 weeks from the time the fire is lighted until it is cool enough to unload. The unloading and loading will take about a week more, so that the total cycle is about 3 weeks. The burned wheels and the small wheels, still in saggers, are removed to the finishing room by electric trucks.

After being removed from the kilns, wheels are sorted, after which they enter the lathe room and are dressed to remove the fire glaze and to reduce the wheels to the exact size required. In the case of wheels for precision grinding, it is obvious that the limits of size tolerance must be much more closely defined than is necessary with wheels for ordinary rough grinding.

The dressing is done with steel star-toothed dressers, which are pressed against the face of the wheel as it is rotated in a special lathe. Some of the finer wheels are dressed with bort or black diamonds held in a steel bar, while the smaller wheels and stones are ground true on horizontally rotated steel lapping wheels with carborundum powder and water.



Stock and Shipping Room

The larger wheels are dressed dry, and naturally there is a dust problem, as the fine flying bits of abrasive must be removed at once if they are not seriously to jeopardize the health of the workmen. To accomplish this each lathe is equipped with a powerful suction collector leading to a dust-collecting chamber.

The dressed wheel is center-cast with lead bushings, after which it is mounted on a mandrel. The mandrel is then placed across two smooth parallel horizontal bars and the wheel allowed to rotate freely until the heaviest point is downward. A counter-poise representing the maximum amount that the given wheel may be out of balance is then applied to the top edge of the wheel and a new trial made. If the same point rolls to the bottom, the balance must be adjusted by the addition of lead near the center or by cutting to a smaller size. The wheel is then rotated at a speed half again as high as the maximum speed that the wheel should attain in industrial use. This furnishes an effective protection against flaws that might cause the wheel to burst in service, with consequent danger to life or property.

Inspection follows, and a series of tests is made on the finished wheel to check it against standard samples of the same wheel. There are three tests—a hammer test to see if the stone rings true; a caliper test to check measurements, and finally, the so-called blade test. A chisel blade is punched by hand into the side of the stone or wheel and with practice the tester can identify the grade, grit and type of wheel. This is a final check on the production order.

Other Abrasive Wheels

In addition to the vitrified wheels that have just been discussed there are many other kinds of wheels produced for various uses. Perhaps the most important are the silicate of soda wheels. Silicate of soda as a binder has long been used in making wheels from the naturally occurring minerals such as emery and corundum. It is still used extensively in making certain classes of artificial abrasive wheels, particularly the free-cutting wheels used for edge tools and cutlery, for cylindrical grinding on centerless grinders and for finishing small stove castings.

The process consists essentially in mixing batches of grain, silicate of soda and various other ingredients and fillers, in Brighton mixers. The sticky mass is then tamped by skilled workmen into paper-lined molds. Much of the quality of the resulting wheel depends upon the proper tamping. The wheels are allowed to dry in a warm room and are subsequently baked in ovens at about 500 deg. F. They are trued to exact dimensions, balanced and inspected in the same way as the vitrified wheels.

One thing at least should be carried away from these articles on abrasive manufacture. It is an industry that would never have been born and could hardly survive a brief interval but for the consistent ingenious application of the principles of that fundamental technology which we call chemical engineering. It is a live, vigorous challenge to those industries that still believe empirical methods must prevail and production of their product has nothing in common with any other industry.

Our thanks are extended to F. J. Tone, president of the company, for his interest, to F. D. Bowman for the many excellent photographs placed at our disposal, and especially to Dr. M. L. Hartmann, chief of research, whose interest and co-operation have made the articles possible.

Arthur D. Little

A distinguished ambassador of science and technology to industry. A successful industrialist himself, he has done much to promote the better understanding of science by industry and has significantly influenced the type of chemical engineer in industry by an intelligent criticism of chemical engineering education.

IT WAS distinctly appropriate that Arthur D. Little should have been one of the speakers at the centennial of the Franklin Institute, and it was even more appropriate that his discourse should have been a plea for the Fifth Estate—the scientific men upon whose shoulders rests the progress of civilization.

Dr. Little has been a pioneer in many lines of work. Always a leader in paper technology, to which he has made notable contributions; an inventor of processes for chrome tanning, for chlorate production and for artificial silk; founder of that remarkable advance in chemical engineering education, the school of chemical engineering practice at the Massachusetts Institute of Technology; past president of both the American Chemical Society and of the American Institute of Chemical Engineers, an unusual distinction which he shares only with Dr. L. H. Baekeland; associated with many big developments in which scientific men have joined, such as the National Research Council, the Superpower Survey, the production of many essentials for war prosecution; by these varied activities Dr. Little has proved himself a man of unusual versatility.

Perhaps this should spur us to read what he has to say about the Fifth Estate, if any spur were necessary. It is an added proof of versatility that no spur is necessary. Literary facility is unusual in scientific men and it is a rare compliment therefore to say that Arthur Little's name as author is a guarantee of thoughtful, enjoyable, literary effort.

The Fifth Estate

This Fraternity, the Creative Workers in Science, Is Responsible for Civilization's Progress and Must Be the Guarantor of Civilization's Stability

By Arthur D. Little
Cambridge, Mass.

BENJAMIN FRANKLIN was not perhaps in all respects a paragon, but he was unquestionably a polygon—a plain figure with many sides and angles. There were not enough buttons on his black coat to tell of the multifarious aspects in which his complex personality was presented to the world. He was craftsman and tradesman; philosopher and publicist; diplomat, statesman and patriot. And he was, withal, a very human being. What concerns us particularly on this occasion is the fact that he was at once philosopher and man of affairs. His remarkable career should refute forever the fallacy, which unfortunately still is current, that the man of science is temperamentally unfitted for the practical business of life.

At the time when Franklin was in England the British Parliament was assumed to be composed of representatives of three estates: the lords spiritual, the lords temporal and the commons; but Edmund Burke, pointing to the reporters' gallery, said, "There sits a Fourth Estate, more important far than they all." No one at all familiar with the ubiquitous influence and all-pervading power of the press would today question the validity of Burke's appraisal. Even then, however, there was present in England, in the person of Benjamin Franklin, a prototype and exemplar of the membership of a Fifth Estate, an estate destined to play an even greater part than its predecessors in the remaking of the world.

What the Fifth Estate Is

This Fifth Estate, to which your attention is appropriately invited on the centenary of the Franklin Institute, is composed of those having the simplicity to wonder, the ability to question, the power to generalize, the capacity to apply. It is, in short, the company of thinkers, workers, expounders and practitioners upon which the world is absolutely dependent for the preservation and advancement of that organized knowledge which we call Science. It is their seeing eye that discloses, as Carlyle said, "the inner harmony of things; what Nature meant." It is they who bring the power and the fruits of knowledge to the multitude who are content to go through life without thinking and without questioning, who accept fire and the hatching of an egg, the attraction of a feather by a bit of amber, and the stars in their courses as a fish accepts the ocean.

The curious deterioration to which words are subject has left us with no term in good repute and common usage by which the members of the Fifth Estate may properly be characterized. Sophists are no longer distinguished for wisdom: they are now fallacious reasoners. Philosophers, who once claimed all knowledge for their province, are now content with speculative metaphysics. Scholars have become pupils. The absent-minded and myopic professor is a standardized property of the stage and screen. The expert, if not under a cloud, is at least standing in the shade. In Boston, one hesitates to call a professional man a scientist, he may be a Presbyterian: and a "sage," as an anonymous writer has pointed out, "calls up in the average mind the picture of something gray and pedantic, if not green and aromatic." Let us, therefore, for a time at least, escape these derogations and identify ourselves as members of the Fifth Estate.

Smallness of Its Numbers

Although the brotherhood of the estate is open to all the world, its effective membership nowhere comprises more than an insignificant proportion of the population. Two hundred and fifty constitute the membership of the National Academy of Sciences. The latest edition of "American Men of Science" includes only about 9,500 names. The number is expanded to 12,800 on the roll of the American Association for the Advancement of Science. Although gathered from all countries and although chemistry is one of the most active and inclusive sciences, the chemical papers, books, and patents reviewed in *Chemical Abstracts* in 1923 were the product of about 22,000 workers. One may hazard the estimate that there are not in all the world 100,000 persons whose creative effort is responsible for the advancement of science.

The studies of Cattell indicate that in America, at least, the great majority of men of science come from the so-called middle and upper classes, or precisely those sections of society which, in Russia, have been practically exterminated in the name of the new Social Justice. In about two-thirds of Cattell's reported cases both parents were American born, while the fathers of nearly one-half were themselves professional men. Seventy-five per cent are dependent upon the universities for support, from which we may assume that the burden of the higher surtaxes does not bear heavily upon the Fifth Estate.

In proportion to population the cities have produced twice as many scientific men as the country, but how many "hearts once pregnant with celestial fire" repose in country churchyards because of lack of opportunity and absence of the stimulus of contact cannot, of course, be known, nor can we tell how many brains, competent and equipped to penetrate the mysteries of nature, the war has cost the world.

Initiative is one of the rarest mental qualities, yet without it progress is impossible. Its combination with the scientific imagination and command of fact is still rarer and more precious. Since comparatively few

Extracts from an address delivered at the Franklin Institute Centennial, Philadelphia, Sept. 19, 1924.

of those who study science develop the capacity to extend its borders, the cost of a man competent to advance science has been estimated at $500,000 and his value to the community set at a far greater figure. Full membership in the Fifth Estate thus seems to involve the highest initiation fee on record. It is a figure disconcerting to the candidate, but as Wiggam has finely said: "Only genius can create science, but the humblest man can be taught its spirit. He can learn to face truth."

Handicap of Terrifying Language

That the Fifth Estate is not better appreciated or always understood by the world at large is not surprising. In their endeavors to secure accuracy of definition and expression its members have evolved a preposterous and terrifying language of their own. It is not ideally adapted to the interchange of confidences in ordinary human intercourse. It does not lend itself to poetry. "Ladybird, ladybird, fly away home" becomes impossible when one is forced to address the prettily spotted beetle as *Coccinella dipunctata*. A primrose by the river's brim is much more than a yellow primrose to the botanist; it is a specimen of *Primula vulgaris*. The organic chemist produces a new synthetic product in a mass of pilular dimensions and bestows upon it a name that would slow up Arcturus. Nothing but static interference can account for the terms of radio telephony. If knowledge is to be humanized, it must first be translated.

Dewar has said that the chief object of the training of a chemist is to produce an attitude of mind. It should be the object of all education to produce the scientific attitude toward truth. We may even agree with Robinson that "of all human ambitions an open mind, eagerly expectant of new discoveries and ready to remold conviction in the light of added knowledge and dispelled ignorances and misapprehensions, is the noblest, the rarest and the most difficult to achieve."

Now vision, a trained intelligence and an open mind are the qualities that characterize all those who are worthy of membership in the Fifth Estate. They are qualities which the many-sided Franklin possessed in exceptionally high degree.

Versatility of Franklin in Science

Among all the activities with which his busy life was crowded Franklin undoubtedly found his greatest pleasure in the pursuit of science, and in that pursuit he followed the eclectic method. At a time when nearly everything awaited explanation his focused attention ranged like a searchlight over many fields. He observed the movement of winds and developed a theory of storms. He considered ventilation and the causes of smoky chimneys and proceeded to invent new stoves. He introduced the Gulf Stream to Falmouth skippers and demonstrated the calming effect of oil on turbulent seas to officers of the British navy at Portsmouth. From earthquakes he turned to the heat absorption of colored cloths and the fertilizing properties of gypsum. He wrote on sun spots and meteors; waterspouts, tides and sound. The kite, which for centuries had been the toy of boys, became in Franklin's hands a scientific instrument, the means to a great discovery. That its significance is, even now, not universally appreciated is shown by the recent answer of a schoolboy, "Lightning differs from electricity because you don't have to pay for lightning." To Franklin, as the child of every man knows, we owe our initial conceptions of positive and negative electricity, and he was the first to suggest that the aurora is an electrical phenomenon.

The gregariousness, which is a prominent characteristic of the Fifth Estate, found early expression in Franklin. He formed the Junta, a club for the discussion of morals, politics and natural philosophy, and in 1744 drew up a proposal for the organization of the American Philosophical Society, of which later he became president. He established a wide acquaintance and cemented many firm friendships among the foremost scientific men of France and England, by whom he was received on equal terms. In 1753 he was awarded the Copley medal of the Royal Society for his discoveries in electricity and on his leaving England, David Hume wrote: "I am sorry that you intend soon to leave our hemisphere. America has sent us many good things: gold, silver, sugar, tobacco, indigo, but you are the first philosopher and indeed the first great man of letters for whom we are beholden to her."

Service Animates the Fifth Estate

The professional spirit which animates the Fifth Estate is essentially one of service. Its compelling urge in the search for truth springs from the conviction that the Truth shall make men free. That spirit finds complete expression in Franklin's statement: "I have no private interest in the reception of my inventions by the world, having never made, nor proposed to make, the least profit by any of them." This impersonal relation to the children of his brain was indeed carried by him to an extent which ordinary human nature would find hard to emulate. "I have," he writes, "never entered into any controversy in support of my philosophical opinions; I leave them to take their chance in the world. If they are right, truth and experience will support them; if wrong, they ought to be refuted and rejected."

Militancy Has a Place in Science

There is, nevertheless, a place for militancy in science. The world needs a Huxley for every Bryan.

Franklin was a man of science, but his career proclaims that it is possible to be a man of science and much more besides. Science was made for life, and life is more than science. Art in its fullest expression may touch deeper springs, human relations and affections may bring richer rewards, and public affairs may make a more imperious claim. With Franklin as their prototype the members of the Fifth Estate may well strive to emulate his devotion to the public service and his broad and constructive interest in human problems and affairs.

Error and misconception have a feline tenacity of hold upon life, and the Fifth Estate, though richly endowed with latent executive capacity, is still in popular opinion regarded as equipped for thought rather than for action. The practical man, busily engaged in repeating the errors of his forefathers, has little time and less consideration for the distracting theories and disconcerting facts of the man of science. Yet who, among the men of action, is more intensely and truly practical than Carty, Baekeland, Reese or Whitaker? Where shall one find a firmer grasp on the details of business than that possessed by E. W. Rice, Jr., Gerard Swope or Dr. Nichols? What quality caused the young director of a research laboratory to find himself responsible for the production of gas masks to protect four

million fighting men? In a time of dire emergency it was a professor of chemistry who organized the great Edgewood Arsenal and developed the means and methods and the trained personnel required to supply munitions for a new type of warfare. It was not to a statesman or a business man or a great manufacturer that the Allies intrusted the supreme command. It was to a teacher in a French military school. The range and value of their public service obscures the fact that Charles W. Eliot was a professor of chemistry and that Hoover is an engineer. The League of Nations is the child of a schoolmaster.

Numerically the Fifth Estate has always been feeble and insignificant. Its total membership at any time could be housed comfortably in a third-rate city. No politician makes a promise or invents a phrase to attract its scattered and ineffective vote. Rarely do its members sit in Congress; when they do, they sit in the gallery.

Accomplishments of the Fifth Estate

With less political influence than the sparse population of Nevada, the Fifth Estate has recast civilization through its study and application of "the great and fundamental facts of Nature and the laws of her operation." It has opened out the heavens to depths beyond imagination, weighed remote suns and analyzed them by light which left them before the dawn of history. It has moved the earth from the center of the universe to its proper place within the cosmos. It has extended the horizon of the mind until its sweep includes the 30,000 suns within the wisp of smoke in the constellation Hercules and the electrons in their orbits within the atom. It has read the sermons in the rocks, revealed man's place in nature, disclosed the stupendous complexity of simple things, and hinted at the underlying unity of all.

Because of this new breadth of vision, this lifting of the corner of the veil, this new insight into the hidden meaning of the things about him, the mind of man, cramped for ages by taboos and bound by superstition, is emerging into freedom; into a new world, rich in promise and of surpassing interest and wonder.

Man brought nothing into the world and through long and painful ages he added little to that nothing: a club, an ax of stone, a pebble in a sling, some skins of beasts, a rubbing of sticks for a fire. He might labor, but to what avail? Even today the South American Indian works incessantly, yet his labor produces little more than heaps of stones. To those who would have us believe that all wealth is produced by labor the Fifth Estate replies, "Wealth is the product of brains, and labor is productive only as it is guided by intelligence."

Science is the great emancipator of Labor. Bagehot has somewhere said, perhaps in "Physics and Politics," that, during the early stages of civilization, slavery was essential to progress because only through the enforced labor of the many could the few have leisure to think. Today, in the United States, the supply of available energy is equivalent to 60 man-power for every man, woman and child. There is now leisure for all to think, but the millions prefer the movies.

It is not Labor, but the trained intelligence of the Fifth Estate that has endowed man with his present control of stupendous forces. It has solved problems that for ages have hindered and beset mankind. It has revealed great stores of raw materials, synthesized scores of thousands of new compounds, furnished the fundamental data that find embodiment in machines and processes and in those agencies of transportation and communication that have made of the world a neighborhood. It has enabled man effectively to combat disease, added years to the average life, and made it better worth the living.

What Are the Recompenses?

With contributions to their credit, which have so enriched and stimulated the intellectual life; which have brought the peoples of the earth together into closer touch than English shires once were; which have revolutionized industry, enlarged the opportunity of the average man, and added so greatly to his comfort and well-being, we may reasonably inquire, "What are the recompenses of the Fifth Estate?"

On the material side they have almost invariably being curiously inadequate and meager. It is incomparably more profitable to draw the Gumps for a comic supplement than to write "The Origin of Species." There is more money in chewing gum than in relativity. Lobsters and limousines are acquired far more rapidly by the skillful thrower of custard pies in a moving-picture studio than by the no less skillful demonstrator of the projection of electrons. The gate receipts of an international prize fight would support a university faculty for a year.

Should Take Proper Place in World Affairs

One may recall that Lavoisier was guillotined by a republic that "had no need of chemists," that Priestley was driven from his sacked and devastated home, that LeBlanc, after giving the world cheap alkali, died in a French poorhouse, that Langley was crushed by ridicule and chagrin in his last days. A month before the war who could believe that within a few years the Fifth Estate in Russia would be utterly destroyed and in Germany and Austria existing at the very edge of starvation? What has happened there may happen again elsewhere if the intelligence of the world does not assume and hold its proper place in the direction of national and world affairs.

It is not becoming that the world expect the light to shine indefinitely when carrying a lantern is often less remunerative than carrying a hod. The money and the years of study required for special training are not recognized as invested capital, and the return from a decade of research is often taxed as the income of a year. Professorial salaries move forward as slowly as a glacier, but they seldom leave a terminal moraine. Yet teaching is our most important business, for a failure to pass on for a single generation the painfully accumulated knowledge of the race would return the world to barbarism.

Though material wealth is rarely acquired by the Fifth Estate, they have the riches of the royal man defined by Emerson as "he who knows what sweets and virtues are in the ground, the waters, the plants, the heavens, and how to come at these enchantments." Their wealth is in the Kingdom of the Mind. It is in alienable and tax exempt. It may be shared and yet retained.

A recent survey by a national magazine would seem to indicate that the majority of men have drifted into

their vocations with little effort of selection and that a very large proportion ultimately regret their choice. This is seldom true of members of the Fifth Estate. Theirs is a true vocation, a calling and election. It brings intellectual satisfactions more precious than fine gold. They live in a world where common things assume a beauty and a meaning veiled from other eyes; a world where revelation follows skillful questioning and where wonder grows with knowledge. Together they share the interests, the communion of spirit, the labors and the triumphs of the fraternity of Science. The law of diminishing returns exerts a control from which there is no escape in agriculture, industry and business. Research alone is beyond the 12-mile limit of its inhibitions.

Confusion From Lack of Scientific Method

Science has so drawn the world together and so rapidly remolded civilization that the social structure is now strained at many points. Statecraft and politics, law and custom lack the plasticity of science and are now in imperfect contact with the contours of their new environment. The result, as events have shown, is friction and confusion. Though our civilization is based on science, the scientific method has little place in the making of our laws.

The history of aristocracies, feudalism, the church, the guilds and the soviets has amply demonstrated that no one class possesses the qualities required for the government of all classes, and we cannot claim them for the Fifth Estate. We can, however, claim with full assurance that the Fifth Estate possesses many qualities, now practically ignored, which could be utilized in government to the incalculable advantage of us all. Its knowledge of material facts, of natural and economic laws, of the factors governing race development and human relations; its imagination, its vision and its open mind should be brought to bear effectively in the formulation of national policies and the solution of governmental problems.

Since most of the troubles that beset mankind have their origin in human nature, it would seem worth the while of those who make our laws to study and apply the findings of the biologists and psychologists as to what human nature really is and the springs of its motivation.

Civilization Requires Leaders and Faith

Plato called democracy "the best form of bad government." It will be the best form of good government only as it develops the capacity to breed leaders and the faith to trust them. The quality of our children will determine the quality of our democracy. If our laws and mores and economic structure continue to discourage breeding from our best strains, if there is to be no adequate recompense for service of the higher types, the time is not far distant when democracy will no longer be safe for the world. If the Fifth Estate were everywhere to be wiped out, as it has been in Russia, the result would be vastly more calamitous than universal war.

Oswald Spengler, in a recent monumental work, forecasts the downfall of Western civilization and would prove his thesis by the history of past cultures. But never in the past has man lived in so compact a world, never has he had such facilities for intercommunication with his fellows, never has he been endowed with such control of natural forces. He has never known himself so well and, above all, never before has he had it in his power to direct so definitely the course of his own development. Our civilization is certainly imperiled, but there will be no downfall if mankind can be taught to follow the light already before it. As lantern bearers, it is the clear duty of the Fifth Estate to show the way.

In the past the world has suffered grievously from lack of knowledge; today it suffers from its rejection or misapplication. Could the springs of human conduct and the affairs of peoples now be regulated only as wisely as we now know how there would be work and leisure and decent living for all. The criminal, the defective, the feeble-minded would be breeded out, and sane minds in sound bodies breeded in. The loss and suffering from preventable disease and accident would not be tolerated. Higher standards would govern the selection for the public service. Planning would replace *laissez-faire* development, and a rational conservation check the reckless waste of our resources. Production and distribution would attain to levels of efficiency altogether new, and the many injustices now existent in human relations would well nigh disappear. With the reaction of a freed intelligence on politics, religion, morals, we might hope for a broader tolerance, a better mutual understanding. With the recognition of the spirituality of science and the divinity of research and discovery should come larger interests and a new breadth of vision to the average man, and to us all acknowledgment of the steadfast purposive striving shown in the development of the created world and a reverent appreciation of man's privilege to aid and further this development.

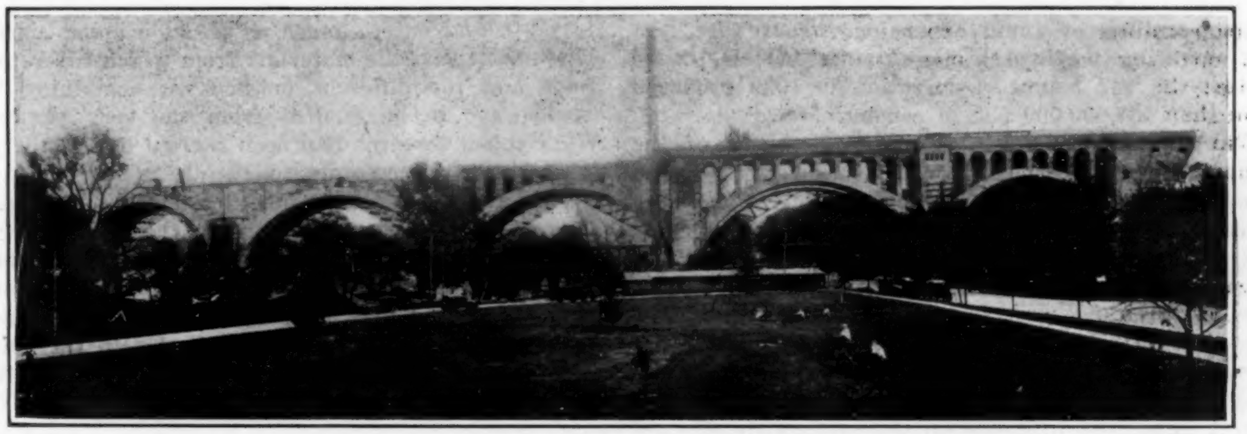
Government by Intelligence Needed

We might reasonably expect ugliness to be replaced by beauty in our cities and small towns and later even in our homes. Government by intelligence for the general good of all should supersede government by special interests, blocs, faddists and fear of organized minorities and the uninformed crowd. With it all would come relief from the economic pressure which bears so heavily upon the Fifth Estate that its children, which should be counted among the best assets of the community, are now a luxury.

The world needs most a new tolerance, a new understanding, an appreciation of the knowledge now at hand. For these it can look nowhere with such confidence as to the members of the Fifth Estate. Let us, therefore, recognize the obligation we are under. Ours is the duty and the privilege of bringing home to every man the wonders, the significance, and the underlying harmony of the world in which we live.

Can This Oil Be Recovered?

An opportunity for the recovery of petroleum from brine and oil seepages exists in Australia, according to Howlette Wilson, of Melbourne, who writes *Chem. & Met.* an interesting description of the occurrence. The brine-oil emulsion is found in a lake about 10 square miles in area, covered with a cake of salt varying in thickness from 1 ft. 6 in. to 3 ft. The oil content is about 10 to 11 per cent. The salt cake contains mostly sodium chloride, with small quantities of calcium and magnesium salts.



Reinforced Concrete Bridge Over Great Miami River at Sidney, Ohio
Concrete for the bridge was proportioned, using methods developed by Professor Abrams at Lewis Institute

How One Industry Concentrates Its Research

45,000 Tests Are Being Made Annually in the Structural Materials Research Laboratory in Chicago on the Fundamentals of Cement and Concrete

By Duff A. Abrams
Professor in Charge of Structural Materials Research Laboratory, Lewis Institute, Chicago

WHEN a certain Western state began the construction of a concrete highway a couple of years ago, the engineers were confronted with a difficult problem. To follow the customary methods of mixing concrete meant either that the coarse aggregate—the gravel or stone—had to be imported from distances that would make the cost prohibitive or that poorly graded local aggregates had to be used. To utilize the material produced near by meant that it had to be screened with a rejection of about 15 per cent and even then the resulting concrete was of low strength.

However, a short time previously, a staff of engineers, chemists and assistants, working in a laboratory in Chicago, had compiled a report that covered years of investigation on that very question of designing concrete mixtures. The State Highway Department brought its problem to the attention of the investigators. Samples of the local aggregate were submitted, cylinders of concrete were made and tested, employing the principles of concrete design that had been worked out previously. By applying the principles of proportioning established by the laboratory's work, it was possible to use all of the aggregate. But, more important still, those same principles produced a concrete 50 per cent stronger than the concrete formerly made. What would otherwise have been waste was turned to profit and a better material was produced because of co-operative industrial research.

The Structural Materials Research Laboratory of Chicago, originated 10 years ago, is now employing on full time a staff of about forty in working out important facts about portland cement and concrete.

In a few sections of the United States concrete construction has been handicapped by lack of a supply of clean, uncontaminated water for mixing. There was little information about the influence of impure mixing waters on the strength of concrete. So the Structural Materials Research Laboratory made and tested about 6,000 concrete cylinders, using standardized aggregates and portland cement, but with practically every kind of water that could be expected to find its way into concrete construction.

Sixty-five samples of water, collected from all parts of the United States, including potable waters, bog waters, sea waters, sulphate waters, solutions of common salt, mine and mineral waters, waters containing sewage and a great variety of industrial wastes, were used in making the test cylinders. At the end of the usual test periods, these cylinders were placed in testing machines and loaded to failure. This series and earlier tests showed that, with the exception of waters high in acid or saline content, those containing sugar, and refuse waters from tanneries and oil refineries, strengths comparable to those obtained with pure water were found.

Behind these co-operative research activities of the portland cement manufacturers is the history of an industrial growth that far outstripped a knowledge of the characteristics of the product. In 1872, David O. Saylor, a Pennsylvania manufacturer of natural cement, impressed by the growing demand for a better product, started the first plant in this country for the manufacture of portland cement. Soon afterward other companies were organized. But development was slow, due to the popularity of the imported portland cements, until in the early '90s, when the industry began a

quarter-century of rapid expansion. There are now 131 operating portland cement plants in the United States; the 127 plants in operation in 1923 produced more than 137,000,000 bbl. of cement.

Throughout those first years, the problems of the manufacturer concerned the production of portland cement; there was little attempt to investigate the characteristics of concrete. But in spite of this early lack of authentic knowledge of its composition and physical properties, the advantages of concrete caused its wide acceptance as a construction material. At that time its greatest use was in mass construction, where it was placed reasonably dry and was usually thoroughly tamped—the very factors that were later found to have a most important influence on the production of good concrete. Rule-of-thumb methods of selecting the aggregates, mixing and placing were sufficient to extend its uses into many fields where durability and safety against fire were sought. But with the introduction of reinforced concrete, involving as it did the use of more plastic mixes, came a growing demand for more definite knowledge of the basic facts involved in the mixing and placing of concrete.

Various government laboratories, including those of the Geological Survey and the Bureau of Standards, were among the agencies early seeking to learn definitely the methods of controlling some of the variables in concrete making. Numerous college, university and commercial research laboratories have contributed valuable information on the subject.

A Co-operative Laboratory

To aid in this research in the field of concrete, the Portland Cement Association, representing the cement manufacturers in the United States, Canada, Mexico and South America, joined Lewis Institute, Chicago, in the formation of the Structural Materials Research Laboratory. At the time of its inception, the staff consisted of eight members and the original contribution by the cement association was about $15,000 per annum. From this small beginning the laboratory developed rapidly and soon required additional room for equipment and a larger personnel. After a few years it was occupying space on three floors. A chemical research department was a somewhat later development. Various testing machines were added, curing rooms were built and recently property was acquired for use in conducting curing experiments and tests of concrete exposed to the weather.

The staff of the laboratory was charged with one duty—to find out as much as possible about concrete. This meant that the materials from which concrete was made and the different methods of combining them would have to be studied from the very beginning. While much research had been carried out in the past, it was largely unco-ordinated.

The laboratory is now making tests at the rate of about 45,000 per year. To make the number of test specimens required and to supply the requirements for correlated tests requires about 10 carloads of stone, sand and gravel and 300 bbl. of portland cement annually. These materials are purchased in the market. Several brands of cement are mixed together to insure a representative sample.

New Truths Discovered

When the laboratory was established, it began a long series of experiments that brought to light many little-expected facts about the art of making concrete.

The first experiments extended over 4 years and about 100,000 tests were made before any results were published. But when the data were sufficient and the results were made public, these tests showed that the strength secured from the cement used was primarily dependent upon the quantity of mixing water. This meant that general practices then in vogue sacrificed much of the potential strength of the concrete due to the use of far too much mixing water.

Involved in the making of concrete are the ingredients, their properties, the mixing and transporting, the placing and the curing—each with its effect on strength and durability.

As the aggregate constitutes from 75 to 90 per cent of the weight of the material in concrete, it is important from an economic standpoint that aggregates obtained near the construction project be used if suitable. Aggregates are of many different types; for example, the laboratory has more than 3,000 different samples of sand collected from all parts of the United States and many foreign countries. Some of these sands have been found desirable for concrete making; others produce inferior concrete and some are entirely unsuitable.

The same careful study has been necessary for the coarse aggregates. Gravels and crushed stones have been sent from all sections of the country and these samples have been tested for their suitability for concrete for given purposes.

An important result of the work of the laboratory has been the determination of definite methods for designing concrete mixtures, whereby the whole problem

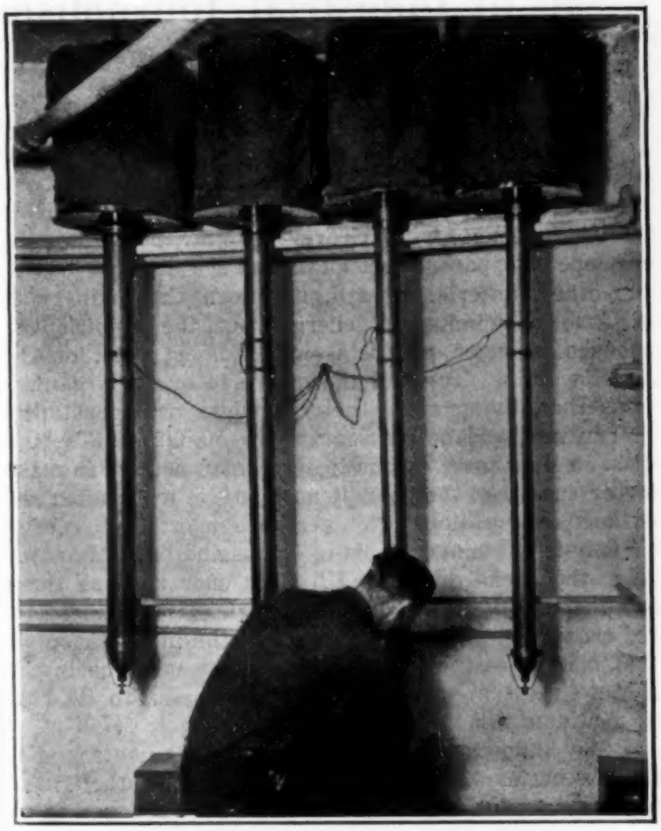
Main Physical Testing Laboratory

View shows two 200,000-lb. universal testing machines and a 40,000-lb. machine used for crushing concrete and mortar specimens.

is worked out on a logical basis, supplanting the former rule-of-thumb methods. More extended uses of concrete for structural purposes and highway construction demanded higher qualities of this material. By applying the results of the investigations of the laboratory, the present-day builder can design his concrete for predetermined strengths and thereby eliminate in part the high allowance previously made for guesswork, with a resultant possible saving in material.

Other Problems Investigated

With the fundamentals of concrete design well established, the laboratory found several closely related problems that entered into concrete construction. Some localities reported trouble with various concrete structures that had been exposed to alkaline waters. Consequently about 6,000 test cylinders were made and stored in tanks of various alkaline solutions near the laboratory. In order to carry the work directly to the districts where the natural exposure could be found, about 2,000 large concrete blocks were set in alkali soil at points



Air Analyzer for Mechanical Analysis of Cement
This apparatus separates the cement particles into sizes ranging from 0.00181 to 0.00035 in. in diameter

in Colorado, South Dakota and western Canada. These cylinders are inspected periodically and information is being secured which will enable us to design concrete for similar exposure.

Then, too, came the question of using various admixtures. The use of soluble chemical admixtures for hastening the setting and increasing the early strength of concrete under certain conditions had gained considerable favor with engineers in the past few years. Two series of tests were instituted by the laboratory to determine the effect of calcium chloride and other commercial compounds. The results of these investigations showed that from 2 to 4 per cent of calcium chloride by weight of the cement may be used without reducing the strength of the resulting concrete.

Study of Constitution of Cement

In April of this year the U. S. Department of Commerce announced that a broad and scientific investigation of the constitution of portland cement was to be undertaken by the Bureau of Standards in conjunction with the Structural Materials Research Laboratory. A director, Dr. Robert H. Bogue, formerly professor of industrial chemistry at Lafayette College, Easton, Pa., is in charge of this investigation, and under him a staff of eight assistants is engaged on this work. In this study the valuable work done previously at the Bureau of Standards by P. H. Bates will be utilized.

This present study will involve more detailed investigations into the constitution of portland cement than have been made heretofore. Although cement today is being employed so widely, the chemical reactions that occur in burning the raw materials into clinker and the hardening of freshly placed concrete have not been definitely determined. Chemical analysis shows what elements are present and the general nature of the compounds, but investigation has not thus far given positive information concerning the real constitution of portland cement as distinguished from its composition and has failed to explain positively the hardening process of the ground cement clinker.

Unlike most industrial researches, the experimental studies carried out in this laboratory are not those directed toward the solution of manufacturing problems or those having to do with economics of cement mill operation. The aim has been to improve the quality of concrete and to adapt it so as to meet the demands upon it at a minimum cost.

Practical Methods Established

The work of the laboratory has gone far beyond the establishment of technical theories. The utilitarian value of such research lies in its acceptance by the user, and it would have gone for naught had it not resulted in simple, easily applied methods for actual field use.

As an example, it was known that organic impurities found in many sands have a deleterious effect on the concrete. The chemical laboratory set about finding a practical way of determining whether or not a sand possessed the requisite cleanness—a test that could easily and cheaply be applied in the field. The result was the colorimetric test for organic impurities. The sand to be tested is shaken in a dilute solution of sodium hydroxide. If after the mixture has been allowed to stand for 24 hours the supernatant liquid is colorless or has a light yellowish tint, the sand may be considered satisfactory; a dark color indicates that the sand should not be used for concrete except in the infrequent cases where careful laboratory strength tests prove that the particular organic material present is not harmful to the concrete. Any inspector can make this test in the field. The necessary equipment can be purchased in almost any drug store for about a dollar.

New Problems in Roads

With the constantly increasing number of automobiles and the consequent demands for more concrete highways came a new problem for the laboratory.

Previous to the time that concrete was used in any great quantity for road work, its wearing qualities were of little importance. Then, too, concrete used in highway construction was subject to quicker drying than in the more massive forms of structural work. The laboratory devised a special test and made an extensive investigation into the wearing properties of concrete and found that considerable resistance to surface abrasion was being sacrificed by the concrete drying out too quickly after being placed. Investigations brought out that concrete properly supplied with moisture for the first 10 days shows 65 per cent more resistance to wear than air-cured concrete.

Sand "Library"
Samples of sand which have been sent in for test from every state in the Union are in these cases

Where special problems have been involved, the laboratory has co-operated directly with engineers, architects and contractors by analyzing aggregates or water used and has often assisted in the design of concrete mixtures.

Bulletins Give Test Results

As investigations are completed, the results are published in the form of papers before engineering and technical societies and in circulars and bulletins issued by the laboratory. The first bulletin was on "The Design of Concrete Mixtures," published in 1918—4 years after the laboratory was organized. Ten other bulletins have appeared. Two new bulletins, "Tests of Impure Waters for Mixing Concrete" and "Calcium Chloride as an Admixture in Concrete," are in press at the present time.

These bulletins are being distributed at the rate of about 15,000 per year. Numerous other papers and circulars are issued for general distribution.

It is our policy to co-operate with other testing laboratories and technical societies to the fullest extent. Experimental work has been carried on in co-operation with such organizations as the American Society for Testing Materials, the American Concrete Institute, the Bureau of Standards, the Bureau of Public Roads, the Associated General Contractors and the California Highway Commission.

Before an investigation is started, the available literature is carefully reviewed—foreign as well as American. To date more than 120 bibliographies have been prepared on as many different subjects relating to cement and concrete. Many of these bibliographies are published for distribution and all are available to the engineer, chemist and investigator.

Selection of Problems

In a field of research offering as diverse problems as does concrete, the selection of the particular problems to be investigated requires most careful consideration. The general policy and program of work for the laboratory are determined upon by an advisory committee consisting of representatives of Lewis Institute and the Portland Cement Association.

The researches of this laboratory, together with the important work being done by a number of other organizations, are exerting a strong influence toward the improvement and standardization of concrete construction. The results of the work of the Structural Materials Research Laboratory are all directed to the end that concrete of a uniformly higher quality may be produced at a lower cost.

Ideals of Industrial Journalism

By James H. McGraw
President McGraw-Hill Co., Inc.

NOT many years ago any assertion of the essential idealism of the American character as manifested in the industrial life of the nation would have aroused laughter both abroad and at home. Today thoughtful men, with clearer insight, penetrate the envelope of apparent selfishness and see that not money, nor other material reward, has been the mainspring of American industrial energy, but the ambition to produce superior products—which is a spark of the artist's divine fire—and the desire to create organizations that, living after their founders, will constantly render new and better services to mankind. To produce steel at lower cost is to serve man better; to make motor cars that the poorest may buy is to broaden the outlook of millions; to generate electrical energy cheaply is to change hovels to homes and to lift burdens from the backs of men. Ultimate ends such as these are the deep-lying stimuli of American industrial life.

Perhaps the slowness to recognize the idealistic spirit that permeates the industrial structure was due in the past to the non-vocal quality of business—to its lack of mediums for the expression of its aims.

Today industry has found its voice. It has found it in the national and regional conventions that have become so vital a part of its life. It has found it to an even greater degree in the industrial and technical press that has grown from infancy to manhood in a generation. As the voice of industry, it is the mission of this press not only to record and interpret the doings of industry but to proclaim and make evident the ideals that underlie industrial service. To do this industrial and technical journals must be something more than publications run solely for profit. They must, if they are to fill their legitimate place, have their own ideals, in correspondence with those of the industries they serve, and adhere unflinchingly to them.

Some of these ideals will at once suggest themselves. Integrity, efficiency, service, for instance, are the ideals of every honest business. That the publishers, man-

Excerpt of an article published in *Electrical World*, Sept. 20, 1924, the fiftieth anniversary number of that publication.

agers and editors of industrial journals have them ever in mind needs not the saying, but perhaps there may be a few aspects of this nationally accepted business idealism which have a special application to industrial publishing and which may be briefly dwelt upon without unduly expanding the obvious.

First among such ideals is independence—the determination of a journal to be its own master, to have no other guides for its opinions and policies but truth and the sound interests of the field it serves. Many men will try to bend its policy to serve their selfish interests, but the publisher who stands fast, who protects the integrity of his reading pages, will have the satisfaction of knowing that he has kept faith with his conscience and his readers, and that those whom he has courageously served will, by their support and confidence, crown his journalistic efforts with success. The right-minded publisher holds that he has a covenant with his subscribers—a covenant to be honest with all and to do harm to no one who is pursuing an honest course. From that covenant he will not depart.

An industrial journal so controlled at once commands respect. If it is to exert influence as well, it must also command ability of a high order. Managerial skill, necessary as it is, will not alone suffice. There must be that rare editorial power, compounded of knowledge, alertness and foresight, that can keep its finger on the pulse of an art and an industry, analyze achievements and comprehend tendencies, that never fails to distinguish rightly between the less and the greater, and that mistakes neither charlatanism for genius nor genius for charlatanism. Not even the editor of an industrial paper, of course, can become infallible, and when he is in doubt he does right honestly to say so; but it is his part to bring to his task of interpretation and guidance all that industry, application and constant contact with his field can supply.

Industrial Press as an Educator

The educational mission of the industrial paper fills an important part in its ideals. To record and interpret all that goes on in its field from day to day, to draw upon the history of the art with which it is connected for instruction and encouragement, to review the past at suitable intervals, to stimulate research and provide a medium for recording its results are vital functions. Nine-tenths of education springs from the contact of mind with mind—the other tenth a man may get for himself if his own mind is fertile enough. Mental contact may come through either the written or the spoken word. In our day it is the written word that plays the lion's share, and a technical paper that proves unable to teach not only the freshman and the industrial neophyte but, on occasion, the master scientist, the veteran engineer and the industrial leader is not fulfilling its mission. To do this the editor does not need to know more than all others; he needs the instinct to recognize achievements in embryo, the insight to divine where knowledge lies, and the tact, where necessary, to coax its possessor into utterance.

To work for the unification of the industry whose spokesman it aims to be is one of the most important among the missions of the technical and industrial journal. To further great modern undertakings, the pure scientist, the inventor, the engineer and designer, the financier, the manufacturer, the executive, the merchant, the salesman, the contractor must work side by side, and the interest of one is, in the final analysis, the interest of all. Commercial ramifications cannot be ignored; progress is built on profit. To promote good understanding, eliminate friction and inculcate a sense of solidarity among all the branches of an industry—these must be included in the high aims that the industrial journal keeps before it.

To achieve all these ends, and thus properly to serve its ideals, an industrial journal must be interesting. That is a hackneyed adjective, applied to everything from a total eclipse of the sun to a comic film, but there seems no other. To be interesting an industrial paper must be well written and well printed. A suggestion of the grace of literature must where possible blend with the austerity of its science, some byplay of wit and homely wisdom temper the solidity of its data and its dicta. Appropriate illustrations, well-considered headlines and tasteful typography must give to its pages that readable aspect upon which even engineers in these times insist. Frivolity, slang and personalities are properly excluded. Dignity is essential.

Journalistic Virility

But this is not all. A paper may be carefully edited, cover its field broadly and be put together in an attractive manner, it may be able to instruct, and yet be lacking in authority and influence. It will then be a good paper, but not a great one. It will follow, not lead. Mild universal approbation is no more the token of the highest success than is a sure and constant balance on the right side of the ledger. The publisher with ideals will not be satisfied with any routine success achieved at the expense of virility. He will exercise and insist on courage wherever courage is called for in preference to "playing safe." He will not rest content unless the business and editorial policies of his journals challenge the respect and confidence of the industries his journals serve. He will covet for these journals an authority that will cause their managers and editors to rank as chiefs and not subalterns in the field. Theirs and his is the duty to point to new paths to be blazed, to erect warning signs where danger threatens, to divine alike what is obsolete and what is rash, and to keep resolutely abreast of progress wherever it may lead.

New Insulating Material Being Developed in Montana

A deposit of phlogopite, a magnesia-mica variety of biotite, at Libby, Mont., is being developed by the Zonolite Co., of Spokane, Wash., and the product, after heat-treatment, is being marketed for a number of purposes, chiefly as an insulating material. The raw product, of which there is a large reserve, is covered by only a few feet of overburden, and can be mined cheaply. It has the characteristic appearance of dark mica, but when subjected to heat it exfoliates and expands to light, fluffy flakes of a golden color. The ratio of bulk in the raw material as compared with the heat-treated material is about 1 to 15. Very little weight is lost in processing.

The expanded material is fireproof to a comparatively high temperature. It forms an excellent insulator against heat or cold. It has been used as a filling in the hollow walls of safes, bake ovens and kilns, and in cold-storage plants at sea and on land. It is available as the base for a decorative paint and as a constituent of fireproof wallboard. Other applications will doubtless be developed as progress is made in research.

"Stainless" Chromium Steels

Their Most Important Properties, Including Detailed Data on Their Behavior in Contact With Corrosives Encountered in the Chemical Engineering Industries

By W. H. Hatfield

Brown-Firth Research Laboratories, Sheffield, England

THE INDUSTRIAL importance of the stainless steels is essentially due to the high percentage of chromium they contain—that is, the well-known non-corrosive properties of the stainless steels cannot be produced, whatever the diverse heat-treatment employed, unless the chromium be present in sufficient quantity. Further developments, or the attendant circumstances involved in their production, have led to steels being produced more complex, but based upon the iron-chromium-carbon series, which contain, in addition to the chromium, such elements as nickel, silicon, copper, molybdenum, etc. The modification in the properties of steels from the standpoint of corrosion, wrought by the addition of various elements, is of considerable interest. In considering the matter, the data presented in Table I, prepared by the author, relative to the solubility of some of the essential elements in acids, will be of interest. It will be noted that the metal chromium is practically resistant to nitric acid; the addition of one-eighth part of this element by weight to the steel confers upon the iron, with which it is alloyed in the form of steel, a resistance to that acid over a greater range of concentration and temperature. It will be noted that nickel is resistant to sulphuric acid, and it is of interest to record that 25 to 30 per cent of this element confers similar extended range of resistance to a nickel steel. In other words, the smaller quantity of the added element confers some of its properties upon the metal to which it is alloyed. The author has shown (*Iron & Steel Inst.*, 1923, vol. 108, p. 103) that the addition of nickel to chromium steels gave increased resistance to sulphuric and hydrochloric acids, and also that the addition of chromium to high content nickel steels greatly increased the resistance of a nickel steel to nitric and hydrochloric acids. It is also claimed that the additions of silicon, copper, molybdenum, tungsten, etc., also further modify the chemical properties of the alloys produced.

The importance of the stainless steels and rustless irons can hardly be overstressed at the present time, for processes are being perfected whereby these materials can be made at greatly decreased cost. Dr. B. D. Saklatwalla, of the Vanadium Corporation of America, says that it is not too much to expect a production cost as low as 4 cents per pound for rustless iron.

The present article will be confined to the stainless steels in which 12 to 16 per cent of chromium is the essential alloy element. These steels have the advantage that whereas stainless or rustless steel, produced by the addition of heavier percentages of alloys, are generally austenitic in character, the straight chromium steels can, with the carbon in the neighborhood of 0.3 per cent, be effectively hardened for the production of cutting implements. They have the further advantage that the presence of the high chromium content raises the carbon change point to more than 800 deg. C., by virtue of which fact reasonably hot manipulation can be done without entering the solid solution range of temperature. This is found to be a considerable advantage in industrial processes, whereby the material is applied to various purposes. However, while the author is essentially dealing with the 12 to 16 per cent chromium steels, he would emphasize the importance of the other corrosion-resisting steels that are now available, to which the additional elements have been added. Such steels, while more costly, yet fulfill satisfactorily more onerous conditions—that is, they resist corroding media which the ordinary, now well-known stainless steel does not resist. The latter, however, as established by its great success when used for cutlery, turbine blades and engineering parts, has a sufficiently wide range of resistance to corroding media to fulfill the general requirements of a non-rusting steel.

It is thus clear that when one speaks of the resistance of a steel or alloy to an acid, or indeed to any corroding medium, one must qualify the statement by adding the concentration, temperature and general conditions of the test. The relative resistance of stainless steel and carbon steel to nitric acid, sulphuric acid and hydrochloric acid is illustrated in Table II.

One extremely interesting experiment, which the author has described before, consisted of immersing two specimens of this stainless steel (in the hardened and tempered condition) in 10 per cent sulphuric acid solution; one specimen had a newly prepared and polished surface, while the other had been immersed for 24 hours in nitric acid, sp.gr. 1.20; but after the immersion in the nitric acid had had the surface perfectly cleaned. These two cylinders when placed in the 10 per cent sulphuric acid displayed a marked difference, the specimen with the new surface remaining unaffected for a few seconds only, and then gas was evolved freely, while the specimen which had been immersed in nitric acid remained passive for several hours. Having in mind that numerous corrosion tests have indicated that 1.20 sp.gr. nitric acid is without influence upon stainless steel and undoubtedly has no apparent influence, yet immersion in it, as in this experiment, was definitely shown to have rendered the steel passive

Presented at the forty-sixth general meeting of the American Electrochemical Society in Detroit, Oct. 2, 1924.

Table I—Solubility of Metals in Acids

24 hours immersion at 15 deg. C. Weight of samples 50 grams. The result is given in loss in weight per sq.cm. of surface

Metal	HCl Conc.	H_2SO_4 10 per cent by vol.	HNO_3 Sp.gr. 1.20 50 per cent by vol.
Iron	—0.0814	—0.0327	—0.7165
Nickel	—0.0037	—0.0002	—0.1546
Chromium	—0.2014	—0.0014	—0.0006
Copper	—0.0018	—0.0002	—0.5708
Cobalt	—0.0480	—0.0150	—0.4210
Manganese	—0.1579	—0.7724	—0.5688
Aluminum	—0.1071	—0.0002	—0.0010
Silicon	—0.0002	—0.0003	—0.0002

in sulphuric acid for a considerable period of time. The only other experimental fact within the author's experience which matches up this experiment is that stainless steel after considerable use is apparently more stainless than when first put into service.

It is clearly necessary that the physical condition of a steel be given every consideration, since the stainless steel may exist in any one of many conditions. For instance, it may be in the hardened condition, it may be in the fully tempered condition, or it may be hardened and tempered to different temperatures and for different periods of time, thus producing a very dissimilar internal architecture and physical condition, as judged by mechanical tests. This aspect of the matter is extremely important when considering the question of stainlessness, where variations in hardness can readily constitute a determining factor as to whether or not such steel resists a medium without staining.

It is, of course, well known that patches of the oxide of a metal, such as scale, will accelerate the corrosion of a metal, and stainless steel is no exception to this rule. If any patches, however small, of the scale and oxide produced during manufacture are left on the finally prepared surface, corrosion will be quickly set up in that locality. Therefore it is imperative, if a satisfactory resistant surface is to be obtained, that a perfectly clean metallic surface be prepared. Included slag and non-metallic inclusions may or may not, but probably will, influence the resistance of steel, and this is largely determined by the composition of the slag and of the non-metallic inclusions. Dirty steel fails to resist some media which are completely resisted by clean steel—that is, steel which has been properly refined and in which the non-metallic inclusions, present in small quantity, are of a different composition from the inclusions that are present in larger quantities and of different composition in steel that has not been properly refined. In attempting, therefore, to study quantitatively the influence of various corroding media on an alloy like stainless steel, the matter becomes extremely difficult, owing to the danger of not being able quantitatively to allow for such influences as the condition of surface and the presence of foreign matter in the steel. However, if the steel is of the correct composition and has been properly refined, then, as found within the author's experience, reasonably consistent results can be obtained even with media in which the effective corroding element or compound is present in small quantity.

When considering the resistance to staining in the case of a table knife, it is quite common to see the statement that a stainless steel blade will not be stained if a spot of vinegar is placed upon it and allowed to evaporate. It is claimed that the mark left by the vinegar can be easily removed by the normal domestic methods employed in washing cutlery. Such a claim is, indeed, a reasonable one. If, however, "vinegar" is studied thoroughly it will be found that the term is really a generic one and does not describe a material of fixed and uniform composition and characteristics. This is well illustrated by an experiment in which the author purchased five vinegars in the city of Sheffield and had them thoroughly analyzed, with the results shown in Table III. Of these five vinegars, the first four were genuine malt vinegars, which would be known in the trade as No. 24, 20, 22 and 22, respectively. No. 5, however, was obviously an artificial vinegar. It will be seen that, while essentially these vinegars consist of an aqueous solution of acetic acid, they contain acid in variable percentage, ranging from 3.82 to 6.12 per cent. It will be noted that the total solids range from 0.32 to 2.46 per cent, and that the phosphoric acid varies from 0.008 to 0.085 per cent. Other important differences are also to be noted.

Table III—Composition or Vinegars

	1	2	3	4	5
Specific gravity at 15°.	1.0197	1.0170	1.0132	1.0137	1.0070
	Per cent	Per cent	Per cent	Per cent	Per cent
Total acids (as acetic)	6.12	5.01	5.38	5.44	3.82
Total solids	2.46	2.45	1.29	1.29	0.32
Ash	0.44	0.45	0.15	0.12	0.02
Total nitrogen	0.08	0.08	0.033	0.039	0.016
equal to protein	0.50	0.50	0.20	0.24	0.10
Total SO_2	0.105	0.108	0.108	0.025	0.008
Sodium chloride	0.23	0.24	0.18	0.17	0.02
Phosphoric acid (P_2O_5)	0.031	0.085	0.087	0.035	0.008
Free sulphuric acid	None	None	None	None	None
Ferrocyanides	None	None	None	None	None
Calculated on original solids:					
Nitrogen	0.70	0.80	0.35	0.41	0.26
equal to protein	4.38	5.01	2.19	2.56	1.63
Phosphoric acid (P_2O_5.)	0.27	0.83	0.94	0.37	0.13

Table II—Action of Acids Upon Steel

In each case the immersion is for 24 hours at the temperature stated and the change in weight is given in grams per sq.cm. of surface.

STAINLESS STEEL

C 0.34 per cent, Cr 13.62 per cent, Mn 0.34 per cent

	Sulphuric Acid Conc. per cent by vol.			Hydrochloric Acid Conc. per cent by vol.			Nitric Acid		
	5	25	50	5	25	50	N/1	50	100
Temperature ° C.	sp. gr. 1.082	sp. gr. 1.297	sp. gr. 1.539	sp. gr. 1.011	sp. gr. 1.046	sp. gr. 1.086	sp. gr. 1.033	sp. gr. 1.20	sp. gr. 1.42
15	0.0880	0.2558	0.0046	0.0162	0.0536	0.0626	0.0032	Nil.	Nil.
40	0.2902	0.6406	0.0115	0.0851	0.3640	0.6180	0.0015	Nil.	0.0001
60	0.4133	0.8787	0.0187	0.0812	0.4027	0.8066	0.0076	Nil.	0.0005
80	0.4592	0.7199	0.2246	0.1043	0.4326	0.8061	0.0103	0.0005	......

CARBON STEEL

C 0.29 per cent, Mn 0.52 per cent

	Sulphuric Acid Conc. per cent by vol.			Hydrochloric Acid Conc. per cent by vol.			Nitric Acid		
	5	25	50	5	25	50	N/1	50	100
Temperature ° C.	sp. gr. 1.082	sp. gr. 1.297	sp. gr. 1.539	sp. gr. 1.011	sp. gr. 1.046	sp. gr. 1.086	sp. gr. 1.033	sp. gr. 1.20	sp. gr. 1.42
15	0.1353	0.2027	0.0020	0.049	0.1367	0.1842	0.0957	0.6766	0.0007
40	0.4004	0.8226	0.0060	0.0866	0.4088	0.6107	0.2820	0.6538	0.0236
60	0.4495	1.2552	0.0105	0.0879	0.4042	0.8341	0.3215	1.3809	0.3970
80	0.4958	1.2741	0.0112	0.0928	0.4112	0.7355	0.3512	1.7278	......

Corrosion Resistance of Stainless Steel

Media Satisfactorily Resisted

Absolute alcohol, acetone vapor, aërated water, ammonium hydroxide, ammonia liquor, ammonium nitrate, apple juice, "azol," beer, benzene (petrol mixture), Benger's food, benzol, bleaching solution, blood, boric acid, brewing materials, calcium hypochlorite, cane sugar molasses, carbolic acid, caustic soda solution, chocolate, cider, claret, colliery waters (some), copal varnish and graphite, cylinder oil, drains, ethyl chloride, formaldehyde, fruit juices, glycerine, hydrokinone developer, inks (some), "Kodak" developer, lemon juice, lime and limestone (emulsion in water), liqueur brandy, lubricating oils, lysol, mercuric cyanide, mercuric iodide, metol (hydrokinone developer), milk (fresh), milk (sour), nitric acid (above sp.gr. 1.062), novocaine, oleic acid, onions, orange juice, Oxo, paraffine, petrol, port, potassium carbonate, potassium cyanide, potassium nitrate, potassium oxalate, pyro soda developer, reservoir water, river water, "Rytol," sauces (table), sewage (general), sherry, sodium bicarbonate, sodium hypochlorite, sodium phosphate, sodium salicylate, soft soap, stearic acid, sugar solution, tan extract (leach liquor and finished extract), tannic acid, tartaric acid, tomato, uric acid, urine, vinegar (malt), whiskey, wood (*a*) greenheart, (*b*) oak.

Media Not Resisted

Acetic acid vapor, acetic anhydride, acetone, alum, aluminum sulphate, ammonium chloride, ammonium sulphate, aqua regia, bromine, calcium chloride, carbon tetrachloride, caustic soda (anhydrous) at 550 deg. C., chloracetic acid, chloric acid, chlorine, chlorsulphonic acid, citric acid, cupric chloride, dry battery mixture, dye liquors (some), ferric chloride (as purchased), ferrous chloride, formic acid, hydrochloric acid, hypo (acid), iodine, lactic acid, mercuric chloride, oxalic acid, phosphoric acid, quinine bisulphate, quinine sulphate, sodium sulphate, sulphur chloride and ammonia, sulphur dioxide at 400 deg. C., sulphuric acid, sulphurous acid, tartaric acid liquor, trichloracetic acid.

It will thus be seen that it is reasonable to infer that a stainless knife in a certain condition of a particular heat-treatment might resist one class of vinegar, while being stained with another. If, therefore, one speaks of the resistance of stainless steel or any other metal to vinegar, he should be careful to specify the type and quality of that vinegar.

Vinegar is essentially acetic acid in water, and one of the interesting facts which the author has encountered in this field is that there are conditions of stainless knives that will resist a large range of vinegars, but that are immediately attacked by acetic acid of similar strength. He considers that the explanation of this is that there is an organic colloid in the vinegar, which is instrumental in rendering the steel passive. There are two other similar cases which the author has experienced—namely, sour milk and lemon juice. It is, of course, well known that lactic acid is an essential constituent of sour milk; stainless steel successfully resists corrosion in the presence of sour milk, but curiously is attacked by lactic acid. Lemon juice does not attack stainless steel, but weak solutions of citric acid in water may do so. It is, therefore, to be inferred that the explanation given in the case of vinegar probably applies also to the latter two instances.

When considering the theoretical side of corrosion, one must bear in mind that the chief agent of corrosion is the oxidizing influence of the atmosphere. Resistance to nitric acid is experimentally demonstrated to be an excellent indication of resistance to atmospheric attack. The high-chromium stainless steel, however, while extremely resistant to pure atmospheric effects, appears to be, generally speaking, unable to resist those media which are responsible for reactions in which hydrogen can be, either directly or indirectly, replaced by iron and chromium, although this is not invariably so.

In the corrosion resistance table is given a brief statement of the result of experiments to date, which have been made in the Brown-Firth Research Laboratories, with a view to determining the resistance, or otherwise, to various corroding media, and it will be seen that it is safe to state that a heat-treated steel containing 12 to 16 per cent of chromium is intrinsically made more resistant by the addition of that element, and that its resistance extends over a wide range of corroding media. It is not by any means clear what the mechanism of this action is, but the author considers that there is evidence that the presence of chromium under strongly oxidizing influences permits of the immediate modification of the surface of the metal in such a way as to produce complete passivity under certain conditions of temperature and concentration of the corroding media. The experiment detailed in the paper in which the preliminary immersion in nitric acid extended the period of passivity in sulphuric acid supports this view.

The influence of corroding media is readily modified by the presence of colloids, and the cases of vinegar, lemon juice and sour milk would appear to support this view, since the isolated acids in each case attack the steel. There is evidence also of another kind which points in this direction—namely, that the organic restrainers used in the acid pickling of ordinary carbon steels undoubtedly will, if added in a critical percentage, prevent the solution of the steel in the acids.

There are many anomalies encountered during the experimental work associated with the development of rust-resisting steel, several of which have been described in this article, while many others, no doubt, remain to be discovered. Although it may be desirable to have a satisfactory working theory, the writer is of the opinion that much further experimental work is necessary and that a much more complete agreement must be reached between the chemist and the physicist concerning the mechanism of the action whereby elements and combinations of elements react one with another, before the fundamental laws can be convincingly postulated.

The author desires to thank the directors of Thomas Firth & Sons, Ltd., of Sheffield, for permission to publish data and information.

Steel Treaters Hold Annual Meeting

A.S.S.T. Meets in Boston and Discusses Ferrous Metals as Used in the Manufacture of Shoes and Ships and Sealing Wax

Editorial Staff Report

> This report contains excerpts from a paper containing useful data on those properties of stainless steel of particular importance to the maker of equipment. An article on the chemical properties of stainless steel also appears in this issue of *Chem. & Met.*

ALTHOUGH the phrase "best yet" has been overworked, it is necessary to use it again to describe the annual convention and steel show of the American Society for Steel Treating at Boston, Sept. 22 to 26. The exposition was held at the Commonwealth Pier in Boston Harbor, the only building in the city capable of containing this the largest annual industrial exposition in the country.

The pier is divided into three great halls. In the first were exhibited furnaces and process equipment of all kinds; in the second were the exhibits of steel manufacturers and the makers of all manner of ferrous metals and metallic equipment, to a large extent corrosion- and heat-resisting in nature; and the third section was devoted to a working exhibition of machine tools, the largest and most complete of its kind ever held.

The technical sessions were held at the Copley-Plaza Hotel each morning and in the meeting room at the pier in the afternoons. Dr. George K. Burgess, director of the United States Bureau of Standards and president of the A.S.S.T., was the master of ceremonies at the annual banquet of the society, which was held Thursday evening at the Copley-Plaza. The events of the evening included the presentation of the Howe medal, for the best paper presented before the society in the past year, to Francis F. Lucas, of the Western Electric Co.

The medal is given in memory of Prof. Henry Marion Howe of Columbia University, and this is the second time it has been awarded. Mr. Lucas' paper contained photomicrographs of 5,600 diameters magnification and described in detail the methods by which such pictures are made.

To the list of six honorary members of the society was added the name of Dr. Kotaro Honda, of Tohoku Imperial University, at Sendai, Japan. He is acknowledged one of the world's most eminent metallurgists and was one of the most distinguished guests from abroad present at the convention. Another was William H. Patchell, president of the Institution of Mechanical Engineers, London, England.

Plant visits were made during the week to the Thomas G. Plant shoe factory, General Electric Co.'s Lynn, Mass., plant and the textile mill of the Naumkeag Manufacturing Co., at Salem, Mass. On Tuesday parties also visited Harvard University and the Massachusetts Institute of Technology.

Wheeler P. Davey, of the General Electric Co., and H. H. Lester, of the Watertown Arsenal, gave two papers on widely differing uses of X-rays in the study of metals. Dr. Davey outlined the methods used in applying X-ray crystal analysis to metallurgy and gave some of the outstanding results thus far obtained. Figures illustrating atomic arrangement of metals having various properties and a diagram of the method used in obtaining X-ray spectroscopic photographs were shown and discussed. Dr. Lester's work consisted of examining castings for the purpose of finding and diagnosing defects that would otherwise appear only after failure. The value of this method of investigation to the foundryman and the consumer is obviously great. An early issue of *Chem. & Met.* will contain an article on this use of X-rays for inspecting castings to be subjected to high pressures and temperatures, as in the manufacture of stills and petroleum-cracking units.

Three well-known authorities on salt baths for heat-treating described their work at the symposium on that subject. The speakers were A. E. Bellis, of the Bellis Heat-Treating Co., of New Haven, Conn.; Sam Tour, metallurgist of the Doehler Die Casting Co., of Batavia, N. Y., and W. J. Merten, of the Westinghouse Electric & Manufacturing Co. A. H. d'Arcambal, of Pratt & Whitney Co., Hartford, Conn., presided. The subject was covered in must the same way as at previous conventions, which means that the baths' chemical neutrality toward steel was the primary topic of discussion. A number of salt mixtures were described in detail and their possibilities and limitations pointed out.

The attendance at this symposium was surprisingly large and the amount of discussion following the presentation of papers showed the interest in this subject to be even greater than that evinced in former years. At the close of previous symposia on salt baths the general feeling has been that there was some doubt as to whether the salt bath had come to stay. This year the feeling was quite different. All those attending seemed to believe that the salt bath is a tool that has a definite place in the science of heat-treating. Opinions still differ as to the magnitude of that place.

The heat transfer characteristics, the *raison d'être* of the salt baths, were covered in even less detail than in previous papers. Apparently but little investigating of an exact nature has been done in this direction.

At the meeting on fuels great interest was shown in "The Intrinsic Value of Heat Sources Versus the Floating Economic Value of the B.t.u.," by E. F. Collins, of the General Electric Co. The keynote of this paper was the fact that the intrinsic value of the B.t.u. content of a fuel varies with the efficiency with which the B.t.u.

are brought to their destination; that the B.t.u. content of a fuel is not a measure of its value under conditions where many of the B.t.u. are dropped by the wayside.

Where electricity is used for fuel, advantage is taken of the great efficiency made possible by "large-scale production of B.t.u.," so to speak, and Mr. Collins cited a case where electrical B.t.u. could compete with oil B.t.u. costing one-sixth as much per million, due primarily to lack of efficient combustion of oil in the small unit.

Hardness Testing Symposium

The Hardness Testing Symposium, now an annual feature of the A.S.S.T., was held Thursday afternoon under the chairmanship of Dr. H. P. Hollnagel. Several workers described hardness tests of different kinds and studies of the relationships among the hardness numbers obtained.

Real progress toward the solution of the riddle of hardness was evidenced by Dr. Samuel L. Hoyt's paper on the Ball Indentation Hardness Test. Dr. Hoyt expounded in detail Meyer's method of analyzing the indentation hardness test so as to obtain figures having a fundamental significance. Such figures can be used for comparing dissimilar metals and provide a basis for a real science of hardness testing.

Stainless Steel and Iron

Of two authoritative papers on stainless steel scheduled for the convention, one was withdrawn until certain negotiations of the manufacturer have been completed and the other also failed to be formally presented due to an accident which prevented its author, O. K. Parmiter, of the Firth-Sterling Steel Co., from arriving in Boston in time to attend the session. Copies of this paper were distributed, however, and the many members and guests who came to Boston to talk "stainless steel" found ample opportunity to discuss the paper informally.

Mr. Parmiter reviewed the history and development of stainless steel and stainless iron of the 13 per cent chromium type. He discussed the problems involved in the manufacture of this material, its composition and the effect of various elements upon it. The heat-treatment, forging, normalizing, annealing and hardening were covered in detail. Many of the physical properties of this material were reviewed, such as heat resistance, tensile properties, corrosion resistance, resistance to acids, solutions and gases.

The author covered in some detail the general properties of stainless steel, including brazing and welding, cold-drawing and cold-rolling, its cutting properties, electrical conductivity and resistivity, magnetic properties, machining qualities, microstructure and thermal conductivity.

Mr. Parmiter's information on these "working properties" is the most recent and complete available. Extracts from it follow:

Brazing and Welding—Stainless steel can be soldered, but due to certain difficulties presented, the process of brazing is to be preferred. It is possible to braze the steel successfully if proper precautions are taken as to composition of brazing material, kind of flux and the temperature of the work. A brass brazing alloy, composed of equal parts of copper and zinc, is recommended. The working temperature is considerably above that customary for such work, being in the vicinity of 1,600 deg. F., which is well above the melting point of the brazing alloy. A paste that has given successful results is made by mixing four parts by weight of borax to one of ferric chloride in hydrochloric acid. This solution is used to form a thin paste with zinc chloride. It is essential that the surface to be brazed be free from dirt, scale and grease.

Stainless steel can be successfully welded by the electrical contact or fusion method. Both of these processes permit of its union to carbon steel. It must be understood, however, that in electric welding, the temperature of the metal at the point of contact is raised very high and that the resulting structure formed will be hard and coarse, with a tendency toward brittleness. Where at all possible, welded work should be softened before further fabrication or treatment.

It is possible to weld stainless steel by means of the acetylene torch, but results are not entirely satisfactory.

Cutting Properties—No claim is made for stainless steel as a suitable steel for cutting metals. Its cutting field is limited to table cutlery, pocket knives, surgical instruments, meat-cutting blades, leather knives, etc. For these purposes it serves admirably. There has been just a little contention in the past as to the extent to which stainless steel is capable of retaining a keen cutting edge. The fact must be taken into consideration that the best knife is the one in which hardness and resiliency are about equally proportioned. This condition can be obtained in stainless steel. The cutting qualities of stainless steel when properly hardened compare very favorably with those of the best grades of carbon steel knives.

Machining Properties—Stainless steel can be annealed very soft. In this condition it will show a Brinell value of about 150, but its machining properties will be poor. It is generally agreed that a very soft steel cuts "gummy," pulls and drags, making it undesirable for any purpose requiring a smooth, clean surface. The same is true of stainless steel.

Good machining properties in this steel cover a range of hardness of from 200 to 300 Brinell. Even at the high point of this range the material cuts well, although a little crisply. For any purpose where sharp angles or machined surfaces free from roughness and unusual distortions are desired, the harder material is recommended. Still another feature of the harder condition of the steel, which is the result of hardening with subsequent tempering, is that in addition to its machining properties, it still retains most of the stain-resisting qualities which it possessed in the hardened condition.

Stainless steel conducts heat very slowly, and its expansion upon heating is less than that of carbon steel. These two characteristic properties in conjunction make drilling difficult. Frictional heat is generated, which is slowly dissipated, causing the drill to unduly heat up and gall, unless precaution in the way of a cooling and lubricating medium is used.

Melting Point—The melting point of stainless steel is higher than that of high-speed steel. From observations taken during the melting of the steel and the pouring and solidification of it into ingots, the melting point has been found to be in the vicinity of 2,750 deg. F.

Thermal Conductivity—The thermal conductivity of stainless steel is poor, being only about one-third that or iron.

Equipment News

From Maker and User

Reconstructing Walls of Furnaces

The Method Described for a Boiler Furnace Will Also Apply to Industrial Furnaces

Complete side wall and front wall patches, using crushed old furnace linings as a refractory base, are being used on oil-burning boiler furnaces at the Glenwood, N. Y., power station of the New York Central R.R. Co. This method of construction was tried out by the plant superintendent and a recent inspection of one of the walls so repaired shows it to be in excellent condition after 8 months service.

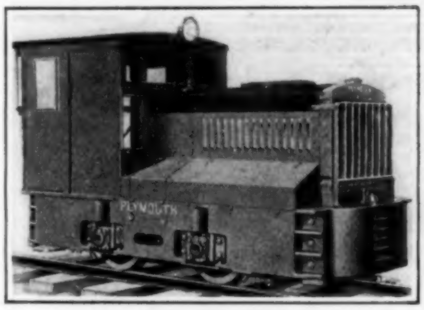
For the side wall patches, expanded metal reinforcement is imbedded in the patch and anchored through the wall, using $\frac{5}{8}$-in. bolts placed at suitable intervals.

The service required is unusually severe, not only on account of the use of oil fuel but for the fact that this station is used to carry peak loads morning and afternoon, with a consequent cooling and heating of furnace walls twice in each twenty-four hours.

The refractory material used was crushed firebrick which had already seen service at high temperature in the same furnaces. This was crushed to $\frac{1}{4}$-in. mesh, using the fines, and mixed with Hytempite made by the Quigley Furnace Specialties Co., of New York, in proportion of 70 lb. of crushed brick to 30 lb. of Hytempite. In making the mixture, Hytempite was first diluted to a heavy pancake batter, and the crushed material gradually added and thoroughly mixed.

One of the walls repaired, as shown in the accompanying diagram, was eaten away to the full depth of the firebrick lining, so that the red brick was exposed. In preparing the wall, all loose material was removed, leaving, as far as possible, the firebrick headers projecting into the space to be patched. The metal reinforcement was then placed and bolts attached, holes through the wall being easily made with an air hammer. Three courses of firebrick were laid at the floor line, giving the wall a thickness of 19 in. at that point, so as to permit the patch to slope back slightly—about $\frac{1}{4}$ in. to each foot in height. This was done to prevent bulging of the wall.

A wood form was then erected in sections and the crushed old firebrick mixture rammed in behind the form after the old wall surface had been prepared with a priming coat of Hytempite followed by a coat of Hytempite batter. This batter coat was applied sectionally as the ramming-in progressed, so as to insure a moist surface that would bond the crushed firebrick mixture to the old wall. The job was completed within 2 days.



Gasoline Locomotive

Gasoline Locomotive

A new model of gasoline-powered industrial locomotive has recently been placed on the market by the Fate-Root-Heath Co., Plymouth, Ohio. This model is known as the DLC, Type 6. It weighs 8 tons. The engine is a Climax four-cylinder engine of 65 hp., with Bosch high-tension magneto with impulse coupling, Simms 12-volt starter, Willard storage battery, Stromberg carburetor, United air cleaner, and built-in governor.

Cooling is by Modine sectional core radiator and 22-in. gear-driven fan. Transmission is of the sliding gear type, four speeds forward and reverse. Axles are of $4\frac{7}{16}$-in. diameter alloy steel. Wheels are 24-in. diameter rolled steel. Four wheel brakes are provided and there is provision for sanding by hand to all four wheels.

This locomotive is built with high cab, 84 in. high over all, enabling the operator to see over industrial cars. The cab has side entrance provided with sliding steel doors.

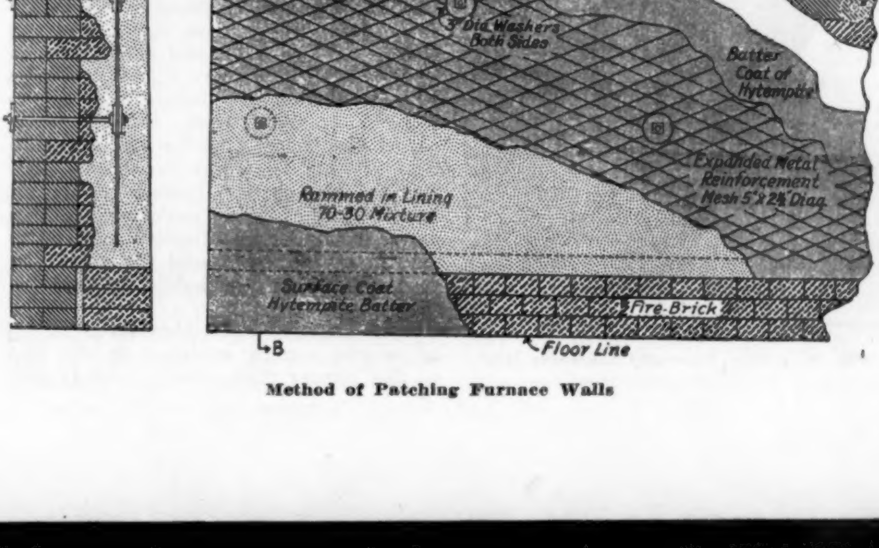
Speeds are $2\frac{1}{2}$, 4, 8 and 12 miles per hour at 900 r.p.m. Draw bar pull, at $2\frac{1}{2}$ miles per hour with sand, is 6,000 lb.; at 4 miles per hour with sand, 4,800 lb.; without sand, 4,000 lb.; at 8 miles per hour, 2,400 lb., and at 12 miles per hour, 1,600 lb.

Improved Scleroscopes

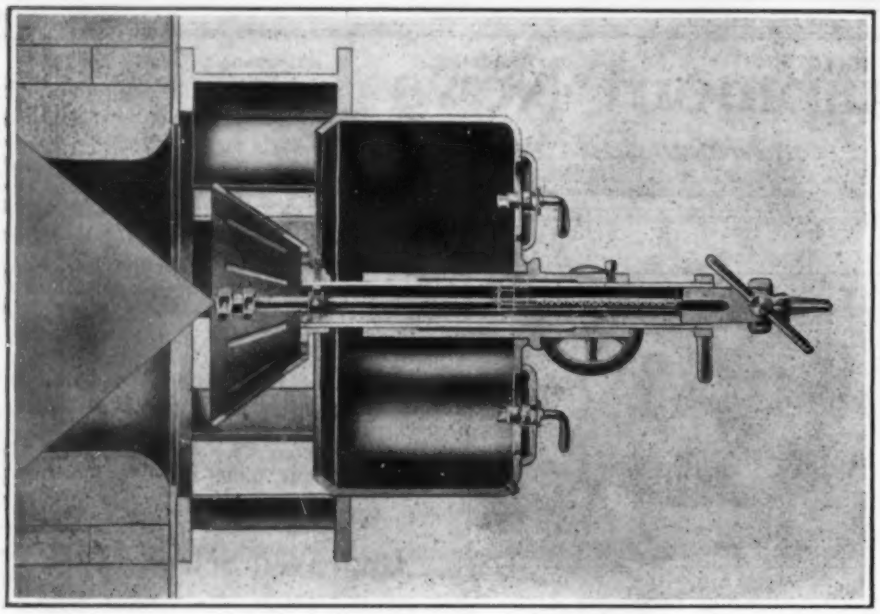
At the International Steel Exposition held in Boston last week in connection with the annual meeting of the American Society for Steel Treating, several new developments were shown in equipment of interest to metallurgists. Among these were improvements in the designs of scleroscope manufactured by the Shore Instrument & Manufacturing Co., 9025 Van Wyck Ave., Jamaica, N. Y. These improvements are shown in the accompanying illustrations, Figs. 1 and 2.

Fig. 1 shows a tilting base and clamping swing arm scleroscope set. This machine is a non-portable combination of units from standard sets. The object of this combination is to enhance its range of adaptability because of the following new features:

1. Greatly increased size to accommodate large work.
2. Has graduated heavy tilting table that can be set at any angle.
3. Has large removable center anvil for specimens that extend through.
4. Has ball-bearing swing arm rigid



Method of Patching Furnace Walls



Outline of Oil Burner in Position at Furnace Front

enough to permit clamping down of specimens.

5. Swing arm can be set in any lateral or vertical position with elastic return to lateral setting.

6. Eliminates necessity for most special holding fixtures otherwise required for mass production testing of odd-shaped pieces.

The scleroscope fitted on to this machine is the same as used in the portable set, with which its dovetail bar is interchangeable. This feature enables the purchaser to make the best possible selection of an equipment to meet his special requirements.

Fig. 2 shows an automatic electric pneumatic actuator for operating scleroscope Model C-1. This actuator is shown at the right of the cut. To the left of the same illustration is shown a vertical scale scleroscope,

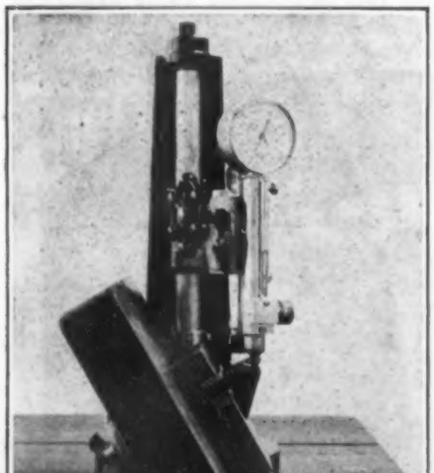


Fig. 1—Tilting Base and Clamping Arc for Scleroscope Set

Model C-1, also a rubber tube for connecting the two machines together. The electric machine keeps going continuously. It has the same suction and compressive force as the operator would have with the usual rubber bulb. It also runs at a speed that is correct for operating the scleroscope as in ordinary service.

By this arrangement a succession of tests can be made without the use of the trigger, except to hold it drawn in, making air connections with the motor. This enables the operator to pass the scleroscope over a surface to be tested in order to obtain quick determination of uniformity, or the average hardness, which is very important in advanced practice. The timing for drawing up the hammer, release and rebound is done automatically by the use of the high-grade slow-speed motor employed and is so calculated that following each rebound the hammer is drawn up before it can fall back on the test specimen the second time. This serves to effect a material saving in hammer wear, as well as in the operator's time.

Oil Burner

Fuel oil burners of the mechanical type, originally developed for the marine field, are constantly attracting more interest in the industrial field. Because of this, there is a marked turning among burner makers to the industrial field, and, their appliances are giving very satisfactory results there.

One of these burners is that made by the Bethlehem Shipbuilding Corporation, Ltd., Bethlehem, Pa. This is called the "Dahl" mechanical oil-burning system. The complete system consists of the burner, furnace front, oil heater, pump, pump governor, suction strainer, discharge strainer, air chamber, inspection tank and the necessary pressure gages, thermometers and relief valves.

The burner proper consists of a tip of special design mounted on the end of the burner pipe, which extends into the furnace front through an adjusting pipe. On the end of the adjusting pipe toward the furnace is a cast-iron cone or deflector of a size depending on the type of furnace front installed. This cone can be adjusted by moving in or out to the position where the flame will receive the proper amount of air for perfect combustion.

The burner is shown in the accompanying cut, fitted to a Bethlehem furnace front with positive air control. The operator can regulate the supply of air exactly by adjusting the area of the air inlet. This is accomplished by means of a rack-and-pinion attachment fitted with a hand-wheel, by which the register check can be positioned for the admission of the required volume of air.

Manufacturers' Latest Publications

Norton Co., Worcester, Mass.—A booklet describing the Norton Porous Plate, a uniformly porous, acid-proof, air-diffusing medium and filter plate.

The Powers Regulator Co., 2720 Greenview Ave., Chicago, Ill.—A booklet describing the Powers mixer for shower bath installations.

Gifford-Wood Co., Hudson, N. Y.—Bulletin 24 A. A folder describing a new type of portable flight conveyor.

The Banner Machine Co., Columbiana, Ohio.—Bulletin 6-24. A catalog describing the construction and use of various types of Banner Triplex Mixers.

E. J. Codd Co., Baltimore, Md.—A folder describing chain shadow pans for conserving heat and protecting workers at open furnace doors.

Bethlehem Shipbuilding Corp., Ltd., Bethlehem, Pa.—Catalog D. A catalog describing the construction, operation and industrial uses of the Bethlehem (Dahl) mechanical oil-burning system.

Tate-Jones & Co., Inc., Pittsburgh, Pa.—Bulletin 163-B. A bulletin on pack-hardening, case-hardening and annealing furnaces of the oil- and gas-fired types.

Chemical Construction Co., Charlotte, N. C.—An illustrated bulletin describing the novel Krause system of spray drying.

General Electric Co., Schenectady, N. Y.—Bulletin 47731, Class 17. A new catalog entitled "Automatic Station Control Equipments." This book treats of automatic control and gives a list of automatic stations installed up to Jan. 1, 1924.

Vilter Mfg. Co., Milwaukee, Wis.—Bulletin 10. A catalog describing the Vilter line of horizontal, double-acting ammonia compressors.

Ingersoll-Rand Co., 11 Broadway, New York.—A new catalog of portable air compressor entitled "100 and 1 Ways to Save Money With Portable Air Power," describing portable air compressors and auxiliary tools and the labor-saving and labor-aiding methods made possible by them.

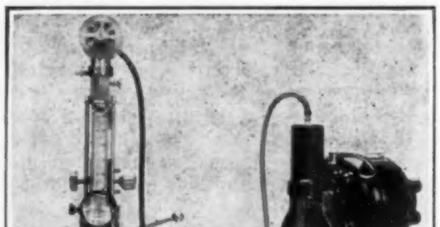


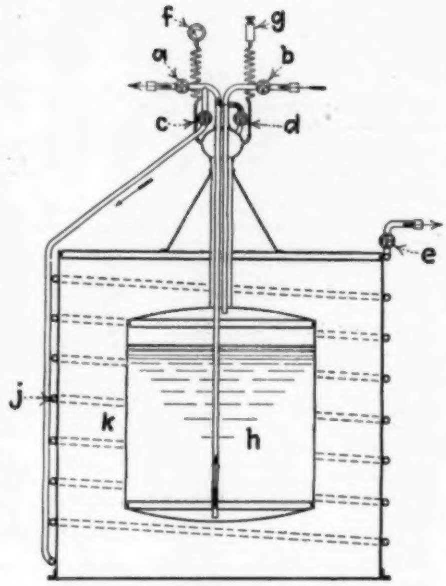
Fig. 2—Automatic Electric Pneumatic Actuator for Scleroscope Set

Review of Recent Patents

Handling Liquid Oxygen

Paul Heylandt, of Berlin-Sudende, Germany, has devised an apparatus for receiving liquid oxygen or other gas at an oxygen plant, transporting it to point of consumption and there serving as storage tank, feeding oxygen under any desired pressure into lines supplying welding or cutting equipment, etc.

Tank *h* is designed to hold from 300 to several thousand kg. of liquefied gas. It is set in the middle of vessel *k*, the space between being packed with a non-oxidizable heat insulator such as slag wool. Tank *h* is filled through valves *b* and when in use is discharged through valves *c* and *e*. Liquid flows out through valve *c* and as it rises through coil *j* it vaporizes, absorbing heat from the slag wool surrounding tank *h* and thereby reducing evaporization in the latter. By setting valves *c* and *e*, gaseous oxygen, for example, may be drawn off through *e* at pressures of 2 to 15 atmospheres, the pressure remaining quite constant for any given setting. (1,505,095, Aug. 19, 1924.)



Handling Liquid Oxygen

Bituminous Composition

Lester Kirschbraun, of Evanston, Ill., prepares an aqueous bituminous composition as follows: Clay or other material containing a substantial amount of colloidal particles is worked up to a thin paste with water. Bitumen is then added in a heated, fluid condition and thoroughly incorporated with the paste by grinding to form an emulsified bituminous matrix. As bitumen, natural or artificial asphalts, pitches and resins may be used with or without the addition of tempering oils. The resulting emulsion may be thinned as desired by the addition of water, as water forms the external phase of the emulsion. Fibrous filler, such as leather waste or wood pulp, may be mixed in to give a composition suitable for flooring. It may be spread cold and as the water evaporates the bitumen particles coalesce to give a waterproof monolithic structure. It may also be applied as paint. (1,506,371, Aug. 26, 1924.)

Lead Peroxide

Byproduct lead sulphate is dried and roasted at 500 deg. C. with free access of air. After grinding to 80 mesh, the sulphate is agitated with 30 per cent caustic soda solution at 80 deg. C. and chlorine passed in rapidly. The heat of reaction is sufficient to maintain the desired temperature. Either pure chlorine or the "blow off" chlorine from an electrolytic alkali plant may be used. The lead peroxide formed is separated from the solution by decanting or filtering, and when free from soluble alkali, it is ready for most commercial uses, generally as a lead peroxide paste. The quality of the peroxide may be improved by stirring the paste at ordinary temperature with a small amount of nitric acid, about 1 per cent of acid to the weight of the peroxide. The paste is then separated from the acid by decanting or filtering. If desired, the paste can be dried and shipped in dry form. (1,506,633, Max Grunbaum, of New York, Aug. 26, 1924.)

Oxalates From Formates

Walter Wallace, of La Salle, N. Y., has made some interesting observations leading to an improvement in the method for producing oxalates of the alkali metals from the corresponding formates.

The common method is to put the solid formate — for example sodium formate—into a heated vessel and bring it as rapidly as possible up to the conversion temperature. It is necessary in order to obtain a good yield of oxalate that the conversion of the formate take place as far as possible at the most favorable temperature. For example, sodium formate when heated decomposes as follows:

(1) $2HCOONa + heat = (COO)_2Na_2 + H_2$, and

(2) $2HCOONa + heat = Na_2CO_3 + CO + H_2$

the formation of carbonate increasing if the temperature of conversion is too high or too low. The reaction commences at about 295 deg. C., but the best yield of oxalate is when the formate is rapidly brought to from 380 to 440 deg. C. While this is readily done with very small quantities of the material, as for instance in a test tube, in the heating of large masses of solid alkaline formate to such temperature, those portions which are first heated by the walls of the vessel are apt to become overheated unless the temperature of the walls of the vessel is kept below 440 deg. C., whereas if the walls of the vessel are kept below such temperature but above 380 deg. C. the sodium oxalate immediately formed on the walls, in the form of a highly non-conducting sponge of solid oxalate and gas, permits only slow heating of the remaining portion of the material, with the result that the conversion of the remainder of the formate takes place at substantially lower temperatures than the most favorable conversion temperature, with the resulting formation of excessive carbonate according to equation (2) above. On the other hand, if such a temperature is maintained on the walls of the vessel that the sodium formate, on its introduction into the vessel, is not rapidly converted in contact with the walls as described above, then the whole mass slowly increases in temperature, with the result that the whole conversion takes place at a temperature lower than the most favorable conversion temperature, with a resulting excess of carbonate formed. The use of stirring does not overcome these difficulties.

By this invention, the formate is melted in one vessel, below the conversion temperature, then supplied molten to the reaction vessel, which is kept heated to maintain the best conversion temperature, and there converted in a few minutes, with approximately 90 per cent yield of oxalate and a minimum of carbonate.

For example, sodium formate is melted, heated to about 270 deg. C., then fed into a conversion vessel previously heated to 440 deg. C. to provide a desired conversion temperature of between 380 and 440 deg. C., this giving the most rapid rate of conversion without overheating and the best yield of approximately 90 per cent of sodium oxalate. (1,506,872, assigned to Oldbury Electrochemical Co., Niagara Falls, N. Y., Sept. 2, 1924.)

Nitrating Wood Pulp

Alfred L. Broadbent, of Wilmington, Del., overcomes some of the difficulties associated with the nitration of such short-fibered materials as wood pulp by blending the wood pulp, which has a relatively short fiber, with cotton in any unspun form, the cotton having a relatively longer fiber than the wood pulp, this blending being done previous to the operations of teasing or picking and drying which precede nitration. The longer-fiber cotton in intimate mixture with the short-fiber wood pulp prevents the drying of the wood pulp into hard compact lumps and gives a mixture that, after passing through a teasing or picking machine, will dry to a fluffy form free from hard lumps, with the fiber opened up sufficiently to permit the nitrating acid freely and uniformly to penetrate all the individual fibers, so that, upon nitration, a superior and uniformly nitrated nitrocellulose is produced. Also, the various difficulties that would ordinarily be met with, and losses that would ordinarily be sustained because of the tendency of wood pulp to penetrate the holes in the apparatus used in the nitrating and purifying operations, are greatly minimized. (1,507,330, assigned to E. I. du Pont de Nemours & Co., Wilmington, Del., Sept. 2, 1924.)

U. S. Patents Issued September 23, 1924

Process and Apparatus for Coating Wire. Alan Standish Dana, Seymour, Conn., assignor to the Kerite Insulated Wire & Cable Co., Connecticut.—1,509,101.

Process for the Manufacture of Inking Surfaces. Etienne Sardou, Fernand Boulle, Segond Mordaci and Emilien Commenge, Marseilles, France.—1,509,112.

Multiple-Unit Tank Car. Victor Willoughby, Ridgewood, N. J., assignor to American Car & Foundry Co., New York, N. Y.—1,509,121.

Beet-Loading Machine. Ellie C. Evans and Patrick C. Roberts, Wiley, Colo. — 1,509,129.

Alkaline Electric Battery. Leopold Grafenberg, Cologne-Lindenthal, Germany, assignor to John Ferreol Monnot, Mill Hill, Middlesex, England.—1,509,138.

Tank-Discharge-Valve Mechaninsm. Oscar Hochberg, New York, N. Y., assignor to American Car & Foundry Co., St. Louis, Mo.—1,509,146.

Tank-Car-Discharge Valve. John W. King, Sayville, N. Y., assignor to American Car & Foundry Co., New York, N. Y. — 1,509,151.

Centrifugal Separator for Pulpy Matter Such as Ground Wood or Straw, Cellulose and the Like. Karl Klimpke, Braunschweig, Germany.—1,509,153.

Process of Recovering Metals From Cyanide Solutions. Arthur H. Lawry, Goldfield, Nev.—1,509,156.

Process of Recovering Wool or Other Animal Fibers From Fabrics. Sidney A. Ogden, Eagle Rock, Calif.—1,509,172.

Clay-Digging Machine. James T. Pokorny, Cedar Bayou, Tex., assignor of one-third to A. T. Eddingston, Port Arthur, Jefferson County, Tex.—1,509,173.

Brick-Molding Machine. James T. Pokorny, Cedar Bayou, Tex., assignor of one-half to A. T. Eddingston, Port Arthur, Tex.—1,509,174.

Yeast Food and Process of Making Same. Gilbert R. Potts, Convent, N. J.—1,509,175.

Glass-Drawing Apparatus. David L. Swindell, Okmulgee, Okla.—1,509,183.

Storage Cell, Electrode Therefor and Process of Making the Same. Raymond C. Brenner, Bayside, and Harry F. French, Flushing, N. Y., assignors to the Prest-O-Lite Co., Inc., New York, N. Y.—1,509,186.

Tunnel Kiln. Conrad Dressler, Cleveland, Ohio, assignor to American Dressler Tunnel Kilns, Inc., New York, N. Y. — 1,509,195.

Distillation Apparatus. Conrad Dressler, Cleveland, Ohio, assignor to American Dressler Tunnel Kilns, Inc., New York, N. Y.—1,509,196.

Method and Apparatus for Producing Strands for Tire Fabric. Hans. E. Grabau, New York, N. Y., assignor, by mesne assignments, to Multiple Cord Corporation, New York, N. Y.—1,509,202.

Apparatus for Treating Cranberries. Henry H. Harrison, deceased, late of Boston, Mass, by Virginia B. Harrison, executrix, Boston, Mass.—1,509,204.

Tile-Making Machine. William A. Hislop, Richmond, Calif., assignor to California Art Tile Co., Richmond, Calif. — 1,509,205.

Deferred-Action Dry Battery. Alton Karl Huntley, Madison, Wis., assignor to National Carbon Co., Inc., New York. — 1,509,209.

Liquid Pump and Elevator. John Edward Louis Ogden, Liscard, England. — 1,509,214.

Process of Making a Lead-Alkali-Metal Alloy. William S. Calcott, Penns Grove, N. J., assignor to E. I. du Pont de Nemours & Co., Wilmington, Del.—1,509,227.

Carbonizing Apparatus. Mathew F. Kevlin, Philadelphia, Pa., and Julian S. Jacobs, Springfield, Vt., assignors to John T. Slack Corporation, Springfield, Vt. — 1,509,239.

Melting-Furnace Car. Walter S. Kupfer, Cleveland, Ohio, assignor to American Dressler Tunnel Kilns, Inc., Cleveland, Ohio.—1,509,243.

Method and Apparatus for Manufacturing Cushion Tires. Carl E. Rett and George S. Anderson, Akron, Ohio, assignors to Lambert Tire & Rubber Co., Barberton, Ohio.—1,509,259.

Method of Obtaining Easily Bleached Cellulose Fibers. Bruno Possanner Von Ehrenthal Cothen, Anhalt, Germany. — 1,509,273.

Process for Lowering the Cold Test of Lubricating Oils. James W. Weir and William J. Ryan, Jr., Fillmore, Calif. — 1,509,325.

Method of Treating Petroleum Oil. James W. Weir, Fillmore, Calif.—1,509,326.

Manufacture of Threads of Any Thickness From Viscose. Emile Bronnert, Mulhouse, France.—1,509,338.

Method and Apparatus for Making Pneumatic Tires. John L. G. Dykes, Chicago, Ill.—1,509,346.

Process of Refining Sugar-Cane Juice. Cyrus Howard Hapgood, Nutley, N. J., assignor to the De Laval Separator Co., New York, N. Y.—1,509,355.

Machine for Washing Rubber and the Like. Fritz Kempter, Stuttgart, Germany. —1,509,357.

High Explosive. John Marshall, Swarthmore, Pa., assignor to E. I. du Pont de Nemours & Co., Wilmington, Del. — 1,509,362.

Rubber Stock and Method of Preparing the Same. Charles Edward Maynard, Northampton, Mass., assignor to Fisk Rubber Co., Chicopee Falls, Mass.—1,509,363.

Method and Machine for Producing Cord Fabric. Thomas Midgley, Springfield, Mass., assignor to the Fisk Rubber Co., Chicopee Falls, Mass.—1,509,365.

Method of Forming Tire Casings. Thomas Midgley, Hampden, Mass., assignor to Fisk Rubber Co., Chicopee Falls, Mass. — 1,509,366.

Vulcanizing Kettle. Josef Talalay, Berlin, Germany.—1,509,380.

Welding. Valentine E. Walter, Brooklyn, N. Y., and William J. Lally, Meriden, Conn., assignors to Thomas E. Murray, Brooklyn, N. Y.—1,509,384.

These patents have been selected from the latest available issue of the "Official Gazette" of the United States Patent Office because they appear to have pertinent interest for "Chem. & Met." readers. They will be studied later by "Chem. & Met.'s" staff, and those which, in our judgment, are most worthy, will be published in abstract.

Complete specifications of any United States patent may be obtained by remitting 10c. to the Commissioner of Patents, Washington, D. C.

Ammonium-Nitrate Explosive. Leon O. Bryan, Wilmington, Del., assignor to E. I. du Pont de Nemours & Co., Wilmington, Del.—1,509,393.

Plastic Composition and Method of Making the Same. Charles E. Kraus, Brooklyn, N. Y.—1,509,406.

Production of Meta-Nitrobenzaldehyde. Don W. Bissell, Buffalo, N. Y., assignor to National Aniline & Chemical Co., Inc., New York, N. Y.—1,509,412.

Triphenylmethane Compound and Method of Producing Same. Don W. Bissell and Robert B. McCann, Buffalo, N. Y., assignors to National Aniline & Chemical Co., Inc., New York, N. Y.—1,509,413.

Method of Making Crepe Paper. Austin E. Cofrin, Green Bay, Wis.—1,509,418.

Collapsible Tube. Samuel Bayard Colgate, Orange, and Martin Hill Ittner, Jersey City, N. J., assignors to Colgate & Co., Jersey City, N. J.—1,509,419.

Closure-Retaining Device. John H. Francis, Cleveland, Ohio, assignor to the Kilby Manufacturing Co., Cleveland, Ohio. —1,509,421.

Carboy. Herbert H. Garis, Easton, Pa., assignor to J. T. Baker Chemical Co., Phillipsburg, N. J.—1,509,422.

Collapsible Tube. Martin Hill Ittner, Jersey City, N. J., assignor to Colgate & Co., Jersey City, N. J.—1,509,431.

Mold for the Production of Air Tubes for Pneumatic Tires. Thomas Baker McLeroth, London, England.—1,509,440.

Azo Dyes. James P. Penny, Buffalo, N. Y., assignor to National Aniline & Chemical Co., Inc., New York, N. Y. — 1,509,442.

Homogenizer for Liquids. Francois Xavier Ovide Trudel, Montreal, Quebec, Canada.—1,509,453.

Hydraulic Molding Press. Josef Van Hullen, Crefield, Germany.—1,509,456.

Process of Manufacturing Esters. Arthur A. Backhaus, Baltimore, Md., assignor to U. S. Industrial Alcohol Co., Inc. — 1,509,463.

Method for the Simultaneous Production of Demineralized Amylaceous Substances and Lower Nitrogeneous Matter for Food Purposes by the Use of Tubers or Cereals in Whole or Broken Grains. Auguste Boidin Seclin, France, and Jean Effront, Brussels, Belgium.—1,509,467.

Plastic Composition. Charles E. Kraus, Brooklyn, N. Y.—1,509,478.

Process for Manufacturing Water Gas. Thomas F. Holden, Washington, D. C., assignor of one-third to Robert D. Weaver, Washington, D. C., and one-third to Calvin Vos, New York, N. Y.—1,509,553.

Process of Producing Oxalic Acid. Charles O. Young, Pittsburgh, Pa., assignor to Carbide & Carbon Chemicals Corporation.—1,509,575.

Process and Apparatus for Treating Gases. Gail Mersereau, New York, N. Y., assignor, by mesne assignments, to Carbide & Carbon Chemicals Corporation. — 1,509,603.

Process of Making Aluminum Chloride. Ralph H. McKee, New York, N. Y. — 1,509,605.

Non-Ferrous Alloy. Roland Northover, London, England, assignor to the Manganese Bronze & Brass Co., Ltd., London, England.—1,509,608.

Alloy. Richard Walter, Düsseldorf, Germany.—1,509,624.

Method and Apparatus for Distillation of Carbonaceous Material. Robert M. Catlin, Franklin, N. J., assignor to Catlin Shale Products Co., New York, N. Y. — 1,509,667.

Method for the Lixivitation of Materials. Einar Morterud, Torderod, near Moss, Norway.—1,509,686.

Apparatus and Method for Transferring Glass Cylinders. John Murphy, Hartford City, Ind., assignor to Window Glass Machine Co., Pittsburgh, Pa.—1,509,687.

Recovery of Arsenic. Charles L. Parsons, Hawkinsville, Ga., and Harry P. Bassett, Philadelphia, Pa.; said Bassett assignor to said Parsons.—1,509,688.

Process for Making Electrodes. John M. Stephensen, Brooklyn, N. Y.—1,509,790.

Dichlorinated Derivative of the N-Dihydro 1, 2, 2', 1'—Anthraquinone-Azine and a New Process for Making Same. Georg Kalischer and Heinrich Salowski, Mainkur, near Frankfort-on-the-Main, Germany.—1,509,808.

Apparatus for Treating Oils. Robert T. Pollock, Brookline, Mass., assignor to Universal Oil Products Co., Chicago, Ill., a Corporation of South Dakota.—1,509,819.

Book Review

Fruit and Vegetable Products

COMMERCIAL FRUIT AND VEGETABLE PRODUCTS. A Textbook for the Student, Investigator and Manufacturer. By W. V. *Cruess*, Associate Professor of Fruit Products, University of California. New York: McGraw-Hill Book Co. Price, $4.50.

A nationally prominent canning chemist remarked to me recently that it was strange that W. V. Cruess had not been retained, for the more direct utilization of his knowledge and experience, by some influential industrial concern. Be that as it may, it is unquestionably true that no better example is available to illustrate the extent of co-operation possible among academic, research and industrial work than the progress made in that branch of applied science covered in the book under review, progress for which Professor Cruess is, to a considerable extent, responsible. The facilities at and the location of the Agricultural Experiment Station of the University of California make possible a close contact with the principal center of the fruit industry of the United States. Professor Cruess is well known throughout California—a state that depends so much for its prosperity on the intelligent handling of its food products—

as an educator who has the rare and happy faculty of utilizing to the best advantage sound fundamental theory and the results of research; one who, moreover, has been responsible for many noteworthy innovations in the industrial application of scientific fact. The book under review therefore is especially worthy of attention by those interested in the subject as well as those who are unaware of the opportunities existing for the utilization of technical knowledge in research and control.

"Commercial Fruit and Vegetable Products" is one of a series of agricultural and biological publications being issued by the McGraw-Hill Book Co. for which Dr. Charles V. Piper is consulting editor. This plan of throwing a measure of responsibility as to the worth of a new book on the shoulders of a specialist of international reputation is an excellent one, which might be followed with advantage in other branches of technology.

The value of a knowledge of the fundamentals of biochemistry to those whose work includes the control of any process in which micro-organisms may play a part is being increasingly recognized. Professor Cruess deals briefly but adequately with the various phases of the subject met with in the canning and allied industries, where fermentation is necessary or to be avoided. A definite knowledge of the life history of molds, yeasts, bacteria and bacilli has made possible the scientific control of food preservation processes. The factor of vacuum has been relegated to a position of less importance than it held previously, and practice is being based more on definite knowledge than on empirical results, the precise reactions leading up to which were often misunderstood.

Those interested in the evolution of ideas that has culminated in the safe canning of moist foods must go back to the researches made in the latter end of the seventeenth century, when Redi, an Italian, found that the appearance of maggots on putrefying meat could be prevented by surrounding it with fine screening, thus apparently exploding the theory of spontaneous generation. Then came revelation by the microscope, and the revival of that theory. English and French scientists maintained that dead matter contained the germs of animalculæ, the development of which was contingent on favorable conditions. The classic experiments of Spallanzani then followed, paving the way for the more scientific research of Pasteur, which formed the foundation for a clear conception of the factors that must be recognized before exact control and scientific processing is possible. The history of canning, as told in Chapter III, is indeed an interesting example of the scope of research in industry. The practical aspects of the subject, in so far as present-day practice is concerned, are discussed in detail. Metallurgical and corrosion problems need study and consideration. The washing, blanching and peeling of fruits and vegetables are dependent to a large extent on chemical control. The use of lye for peeling is a comparatively recent development, which has effected considerable economies, without adversely affecting the character of the product. Exhaustion and sterilization to be effective must be under mechanical control, to the exclusion of the personal element; temperature-recording instruments are finding wide application. The recent development of a continuous-pressure sterilizer, by which cans are automatically admitted to and removed from the steam chest without release of pressure therein, is a significant step forward in the elimination of batch processing and the achievement of a more precise and more regular mechanical control of an important step in the process. The underlying principle may find application outside the canning industry.

The author is specific in giving data relating to every problem in the fruit and vegetable canning and allied industries. Labor-saving equipment plays an important part in the scheme of operations. Evaporation of water from juice or pulp is a necessary step in the utilization of many fruit and vegetable products; here, as with filtration, chemical engineering equipment is finding satisfactory application. Drying practice has undergone considerable modification in recent years, especially since the importance of humidity control has been recognized. Chapters on the manufacture of vinegar, pickles, vegetable oils, the utilization of waste products and the manufacture of byproducts supply essential information. In summary, it may be said that the book, apart from its educational significance, should be an inspiration to all who need an example of the importance of research and precise technical control in the foodstuffs industries, and an indication of the opportunity that exists for trained chemists. A. W. ALLEN.

Books Received

The Science of Metals

THE SCIENCE OF METALS. By *Zay Jeffries*, Consulting Metallurgist, Aluminum Co. of America, and *Robert F. Archer*, Metallurgist, Research Bureau, Aluminum Co. of America. 460 pages. Illustrated. McGraw-Hill Book Co., New York. Price, $5.

Metals and alloys that have been made and used for thousands of years have been subjected to scientific study for only about half a century. More and more attention has been devoted to the systematic investigation of the structure and properties of metals and alloys until at the present time the rate of accumulation of data is almost too rapid for digestion. The need is for a better classification and a more fundamental analysis of this knowledge, and it is in the hope of meeting this need to some extent that this book is published. About half of the material has already appeared in *Chem. & Met.* in the form of articles. Modern theories of metal structures and the changes which they undergo when subjected to various treatments are treated in such a manner that they are not at all difficult to understand.

Qualitative Analyses

ELEMENTARY QUALITATIVE ANALYSES. By *J. H. Reedy*, Assistant Professor of Chemistry, University of Illinois. 139 pages. Illustrated. McGraw-Hill Book Co., New York. Price, $1.50.

Professor Reedy has presented a system of laboratory and quiz room instruction developed during recent years in the elementary courses in qualitative analysis in the University of Illinois. Several new methods are included which have been found to give better results than the older procedure.

Bibliographies on Refractories

BIBLIOGRAPHY OF MAGNESITE REFRACTORIES. Compiled by members of the Refractories Division of the American Ceramic Society, Columbus, Ohio.

A BIBLIOGRAPHY OF SILICA REFRACTORIES. Compiled by members of the Refractories Division of the American Ceramic Society.

These are the first of a series of bibliographies being prepared by the American Ceramic Society. The material is arranged chronologically and has been brought down to the year 1921.

Business Graphs

GRAPHIC STATISTICS IN MANAGEMENT. By *William Henry Smith*. 360 pages. 242 illustrations. McGraw-Hill Book Co., New York. Price, $4.

This is the first book devoted to a discussion of statistics and graphs and their joint use by business men for specific business purposes. It aims to help the business man to understand what others are doing in the ultilization of statistics and to establish within his own business a statistical and graphic practice suited to his specific needs. It explains concisely and practically the principles of statistics and their graphic presentation.

Complex Salts

COMPLEX SALTS. By *William Thomas*, Lecturer in Chemistry, University of Aberdeen. 118 pages. Illustrated. D. Van Nostrand Co., New York. Price, $3.75.

Dr. Thomas has presented a comprehensive survey of the difficult field of inorganic complex salts.

New Publications

"CHEMISTRY IN THE SERVICE OF THE STATE" is the title of a new bulletin sent out through the State of Wisconsin by the chemistry department of the University of Wisconsin. The background of chemical development and its relation to agriculture, industries, health, disease, research and future problems of the race are set forth in the pamphlet.

"HEAT LOSSES THROUGH INSULATING MATERIALS," by R. H. Heilman, is the title of a pamphlet being distributed by the Philip Carey Co., Lockland, Cincinnati, O. The article is reprinted from *Mechanical Engineering*.

News of the Industry

Summary of the Week

American Electrochemical Society meets at Detroit to discuss corrosion, electric-furnace iron production and other outstanding problems.

German manufacturers of dyes expect increase in sales to this country as result of tariff reduction.

Treasury Department refuses to issue anti-dumping order against importations of cement.

Chemical Equipment Manufacturers hold second annual meeting, plan for Providence exposition and elect officers.

Official returns show substantial gains in exports and imports of chemicals in August as compared with July.

Withdrawal of one company breaks up German Glauber Salt Convention and prices immediately declined 30 per cent.

W. C. Geer, vice-president of the B. F. Goodrich Co., announces resignation from active service as head of research department.

Conference called of all industries using forest products to discuss common problems, including means for more efficient utilization of raw material.

University of Pennsylvania announces that graduates in chemical engineering may not obtain degree until after 7 years of practical experience.

Electrochemists Discuss Outstanding Problems at Detroit Meeting

TWO HUNDRED members and guests of the American Electrochemical Society were registered when the forty-sixth general meeting of the society opened at the Hotel Tuller, Detroit, on Oct. 2. The symposium on corrosion under Chairman Saklatwalla drew a large attendance, partly because of the essentially electrochemical nature of the problem and partly because of its international scope. The first part of this symposium was devoted mainly to papers of English investigators, including "The Influence of Emulsoids Upon the Rate of Solution of Iron," by J. Newton Friend, D. W. Hammond and G. W. Trowbridge, and "The Stainless Chromium Steels," by W. H. Hatfield.

F. N. Speller reviewed various theories of corrosion that have been put forward during the past 20 years and showed that all except the electrochemical have proved inadequate to explain the great variety of corrosion phenomena and have been discarded as a result. He stated that all investigators now accept and support the electrochemical theory.

The round-table discussion on "Electric Furnace Cast Iron," of which George K. Elliott was chairman, was opened by Dr. Richard Moldenke. This meeting was attended by a large number of practical foundrymen using both electric furnaces and cupolas. The discussion centered around the relative merits of these furnaces and the economic and technical conditions under which they should be used. The consensus indicated that the electric furnace has a logical place in foundry practice due to the superiority of its product over that of the cupola for castings to be used for special purposes.

On Thursday afternoon a party of seventy-five visited the River Rouge plant of the Ford Motor Co. The iron and steel furnaces, byproduct coke ovens and manufacture of closed car bodies and of tractors were inspected. In the evening the board of directors of the society met for the transaction of routine business. It was decided to hold the spring meeting at Niagara Falls, when a special symposium on fused electrolysis will be a feature of the programs. The 1925 fall meeting place was not definitely decided upon, but the preference was expressed for some place in the South. In this connection the invitation received from Chattanooga, Tenn., was favorably considered. At this meeting a symposium on production of fertilizer materials, including nitrogen fixation, is scheduled.

Committees were appointed on electrochemical education and the electrochemistry of gases. The former is headed by R. M. Burns, the latter by S. C. Lind.

Previous to the meeting, on Wednesday evening there was an informal get together with a wild duck dinner at the St. Clair Country Club on the Canadian side, attended by about forty members, guests and ladies. On Thursday evening a smoker was held by the men at the Hotel Tuller, while the ladies at the meeting attended the theater.

Practical Experience Stressed as Prerequisite to Degree

The board of trustees, University of Pennsylvania, has voted to adopt revised and more rigid requirements from graduate candidates for the degrees of chemical engineer, electrical engineer, civil engineer or mechanical engineer, from the Towne Scientific School at the institution. Heretofore those seeking such degrees have been required to get 3 years practical experience and to write a thesis on some technical phase of their particular branch of engineering. In the future candidates must be in active practice for at least 7 years and in charge of important work in their field for 3 or more years.

Ontario May Become Great Iron Center

Ontario's Department of Mines is anxiously awaiting further and more complete reports upon an important iron ore strike which, it has been reported, has been made in the Sudbury district. If early reports are true, there has been a find of bessemer grade ore. According to information that has already reached the department, a party of prospectors, while drilling for iron a comparatively short distance directly north of Sault Ste. Marie, have showing of a 30 to 60 ft. wide vein of hematite ore, running 65 to 75 per cent.

Charles McCrea, Minister of Mines, states that if the claims are substantiated, Ontario will take a place second to none in the world as an iron-producing centre.

Imports of Chemicals Gained in August

Exports Also Were Ahead of the Totals for July—Soda Group Prominent in Export Trade

Imports of free list chemicals increased 30 per cent in August as compared with July, but are somewhat less than imports in August, 1923. The value of chemicals imported during August totaled $5,963,169. There was a falling off in the value of dutiable chemicals imported. The August total was $1,707,300, as compared with $2,367,923 in July and $2,742,839 in August of 1923. The value of coal-tar chemicals imported during August was $1,728,781, a sharp upturn from July, when the total was $881,474. The August total is about $700,000 greater than that of August, 1923.

Imports of fertilizers also contributed to the larger total. The August import figure was 109,445 tons, as compared with 86,770 tons in July. Comparative figures covering certain imports are as follows:

	August 1923	August, 1924
White arsenic, lb	1,335,402	570,970
Citric acid, lb	67,100	448
Formic acid, lb	43,347	78,518
Oxalic acid, lb	160,402	247,516
Tartaric acid, lb	119,696	88,632
Copper sulphate, lb	....	99,257
Potassium carbonate, lb	589,832	295,982
Potassium hydroxide, lb	760,149	570,791
Potassium chlorate, lb	....	507,389
Sodium cyanide, lb	1,079,532	1,581,281
Ferrocyanide, lb	44,851	218,524
Sodium nitrite, lb	391,481	46,222
Creosote oil, gal	3,586,488	10,417,622
Naphthalene, lb	963,775	263,988

Exports of chemicals in August exceeded those of July by $611,150. A part of the increase was contributed by the soda group. August exports totaled 25,049.941 lb. Pigments, paints and varnishes exported were valued at $1,019,462, approximately the value of exports in July.

There was a decrease in exports of fertilizer materials. August forwardings abroad totaled 87,707 tons, about 10,000 tons less than the July total.

Sulphate of ammonia shared in the decline. August exports aggregate 7,289 tons, as compared with 9,081 tons in July and 8,653 tons in August, 1923.

The explosives total was 1,275,974 lb., which represents the same volume of business moving in July. The comparative figures of certain items on the export list follows:

	August, 1923	August, 1924
Bensol, lb	4,544,270	5,823,443
Sulphuric acid, lb	1,619,840	851,858
Acetate of lime, lb	625,593	727,709
Bleaching powder, lb	2,292,534	1,420,088
Potash chlorate, lb	6,049	27,531
Potash bichromate, lb	146,863	127,227
Cyanide of soda, lb	535,002	22,733
Soda ash, lb	2,360,567	2,841,138
Soda caustic	9,604,318	6,872,574

American Orders for German Potash Reach Large Total

The German potash syndicate on Sept. 1, say advices from Germany, had on its books American orders for potash aggregating $26,000,000. The total would be larger, the Germans believe, were American buyers convinced that no price reductions were forthcoming. It is stated that price reductions are expected as a result of the improving credit facilities.

The potash industry as a whole is in greatly improved condition, it is stated, due to the agreement with the French, the prospect of better credit facilities and because of the increased prices of agricultural products. Exports are being slowed down materially because of the lack of freight space in ocean bottoms.

Calcium Cyanamide Production Increased in Germany

Despite the dampening influence of government control the manufacture of calcium cyanamide perseveres in Germany. Manufacturers are reported to have been able to dispose of their entire stocks during the fertilizer years ended May 31, 1923, and May 31, 1924. The German manufacturers of cyanamide claim a special excellence for their product as compared with fertilizer salts derived from direct ammonia synthesis, on the ground that the 20 per cent nitrogen content along with the partly soluble calcium content meets fertilizer requirements better.

The cyanamide plants at Trostberg and at Piesteritz have been enlarged and determined efforts have been made to secure government approval for developing more of the water power on the Inn River, so as to increase the output at the Bavarian cyanamide plants on that stream.

German Dye Manufacturers Look for Larger Sales in U. S.

While German dye manufacturers expect an increase in their American sales as a result of the reduction in the duty, they apparently do not expect the tariff reduction to deprive the American industry of any of its vitality. An article in a recent issue of the *Berliner Tageblatt* declares that "American manufacturers already have shown their ability to survive competition." Other extracts from the article follow:

"The reduction of the American customs duty puts the American dyestuffs industry to a test that it has not been confronted with in the 10 years of its existence. It is conceded that American dyes are inferior in quality to German dyes. The American textile industry prefers German dyes because they are more color-fast than American dyes. In order to prevent the German dyestuffs industry from partly recovering its pre-war market in the States, the sales organizations of American plants have been reorganized somewhat in the past few weeks. At the same time, hundreds of trademarks have been registered. These trademarks frequently carry with them some inference as to color-fastness, as for instance, 'Permafast' and 'Dye-fast.'"

The Russian Textile Association is again purchasing dyes in Germany, it is reported, following the suspension of such purchases as a result of the recent diplomatic conflict. The Russian textile industry seems to be gathering momentum and is expected to be a good customer for German dyes. Purchasing by a Russian commission in Berlin is regarded by the German manufacturers as highly desirable, since it would be very difficult under present conditions to ascertain the solvency of the individual textile mills.

Japan's discrimination against German dyes has closed this profitable outlet and continues to have a depressing effect on the German dye industry.

Summers Elected President of Chemical Salesmen's Ass'n

The Salesmen's Association of the American Chemical Industry held its annual meeting at the Druachem Club, New York City, on Tuesday evening, Sept. 30. The speaker of the evening was E. J. Mehren, vice-president of the McGraw-Hill Co. Mr. Mehren spoke very interestingly on "Economic Conditions in Europe."

The results of the election of new officers of the association were announced as follows: President, Dr. F. P. Summers, Noil Chemical & Color Works; first vice-president, E. J. Barber, White Tar Co.; second vice-president, J. G. Harrison, Rollin Chemical Corporation; third vice-president, H. F. Wilmot, Synthetic Organic Chemical Manufacturers Association; secretary, W. H. Adkins, Monsanto Chemical Works; treasurer, Robert Quinn, Mathieson Alkali Works; executive committee, John A. Chew, Warner Chemical Co.; Alva H. Pierce, Grasselli Chemical Co., and Burnell R. Tunison, U. S. Industrial Alcohol Co.

Reports of the various officers and committee chairmen were read and accepted.

Canadian Paper Co. Discusses Pulpwood Embargo

Interesting views on the much talked of embargo of wood pulp exports to the United States and the suggestion of the possibility of a further reduction in newsprint prices featured the annual meeting of the St. Lawrence Paper Mills, Ltd. President N. A. Timmins said the proposed embargo would be a good and desirable step from the point of view of the country at large and suggested that there should be a tax of a few dollars at the start, which should be increased each year so that eventually a situation would be created that would be to the advantage of those who are developing the industry in Canada. In the meantime such a graded scale would give the mills of the United States an opportunity to adapt themselves to changing conditions.

Ernest Rossiter, vice-president and general manager of the company, also referring to an embargo, stressed the entire lack of united front on the part of the paper manufacturers of Canada. He pointed out how impossible it was for the government to handle the situation until the manufacturers got together and agreed on a national policy. Speaking of the Royal Commission, which was appointed by the government to investigate the pulpwood situation, Mr. Rossiter said it had accomplished nothing.

Washington News

Anti-Dumping Order Against Cement Imports Refused

In a letter to the appraiser at the Port of New York, under date of Oct. 1, Assistant Secretary Moss, of the Treasury Department, stated that investigation by the department had failed to disclose grounds for the application of the anti-dumping act to cement and instructed that appraisement reports be no longer withheld.

The charge had been made that portland cement was being imported into coast cities from Norway, Denmark, Belgium and other European countries at less than the prices for which it was sold abroad. Following is an extract from the finding of the department:

"Neither the evidence adduced by the domestic manufacturers nor the official reports of the customs investigating officers established with any certainty or definiteness that as a general practice, and taking into consideration the very great differences in wholesale quantities, cement has been sold to the United States by any of the countries in question at less than the foreign home market value. Moreover, this situation involves a number of doubtful questions of appraisement."

Mexico Offers Field for Sale of Insecticides

According to a report from Vice-Consul Herman C. Vogenitz, there is a demand in Yucatan for chemicals that will either kill or drive mosquitos and flies from houses, screened and unscreened. A French compound for burning, composed of compressed chrysanthemum leaves, in the form of small cones, has a considerable sale and retails to the public at a price of 1 peso for a small triangular box. Another preparation in the form of sticks about ¼ in. in diameter is also offered on the market at a price of 1 peso, 50 centavos per box of ten sticks. Both of these products, however, are very inefficient, as they burn quickly and, as soon as the smoke has diffused, insects return freely. It is believed that compounds made in the United States, which are efficient when vaporized within houses, would have a good market in this district.

Morrocan Phosphate Offered in European Countries

Systematic steps are being taken by the Moroccan phosphate interests to furnish a definite portion of the requirements of several European countries. Such information as is reaching this country in regard to the management of that enterprise indicates that the American industry has a formidable competitor now that the standard-gage railroad has been completed from Casa Blanca to the mines at Elbouroudj. The effort to furnish only a portion of the requirements of various countries, rather than attempt to exclude all competitors from one or two countries indicates a desire to establish a well-rounded demand that will give greater stability to the industry. The new loading facilities at Casa Blanca have a capacity of 300 tons of phosphate per hour.

The American industry also has a growing competitor in the Australasian islands. The interests there are evidently intent upon annexing all of the business in the Far East.

Utilization of Forest Products to Be Discussed

A conference to discuss utilization of forest products has been called by the Secretary of Agriculture, to be held in Washington, in the auditorium of the National Museum, Nov. 19 and 20. In his preliminary announcement the Secretary says:

"The question of timber supply is becoming more acute year by year. We are studying it from three angles: First, how to protect the timber we have from fire, insect pests and plant diseases; second, how to encourage the growing of more timber, both on the national forests and private forests; third, how to cut down the waste in manufacture and use of wood."

The conference is called to obtain national recognition of the fact that better utilization of forest products ranks with forest protection and timber growing as one of the three essential elements of an effective forestry program, and to establish a nationally representative advisory committee to assist the Secretary of Agriculture in formulating and carrying out adequate measures to insure the most efficient development and use of our forests.

The Secretary asks all interested associations and organized interests, whether lumbering interests, manufacturers using lumber or builders, to select delegates to represent them at the conference.

Italian Matches Compete in World Markets

Important inroads have been made on the domestic match industry in Poland by the introduction of wick matches of Italian manufacture. The wick is stiffened with hard paraffine. The match has a phosphorus strike-anywhere tip. The Italian matches are more expensive than those made in Poland, but are selling readily despite that fact.

Significance is attached to this development in Poland, since it calls attention to the possibility of a similar inroad in our market. The Italians have been pushing their matches in world trade with marked success. A duty of 40 per cent ad valorem on wick matches is provided in the tariff act of 1922. This is not thought to be an important barrier, since its addition to the price at which the matches otherwise would sell is not sufficient to have an important bearing on their salability. In this connection it is recalled that Mexican manufacturers of wick matches on several occasions have been able to market large quantities of their product in certain localities in the United States. Their lack of financial support and the failure to promote sales systematically are thought to have had a bearing on their lack of success. Were the better equipped Italian interests to undertake to enter this market, the novelty of their product might displace a considerable quantity of domestically manufactured matches, at least during the time the fad was in vogue.

In this connection thought is expressed that any such inroad could be precluded by the domestic manufacturer of a similar match novelty.

Helium Reserve Is Short

It will be several months after the arrival here of the dirigible "ZR-3" from Germany before the "ZR-3" and the "Shenandoah" will be seen flying together. It is learned at the Lakehurst Naval Air Station that there is a shortage of helium gas, which probably could not be supplied in adequate quantities until early next year. The helium shortage is attributed to the failure of Congress to appropriate sufficient funds to recover helium from the Texas oil fields near Fort Worth. The Bureau of Standards has estimated that there is enough gas there to supply a fleet of twenty ships of the "ZR-3's" dimensions with gas for 30 years, but that a 40-mile pipe line costing $100,000 is needed to recover it. It is this money which Congress neglected to provide.

Ammonium Nitrate at Auction

Notices have been issued by the War Department to the effect that 1,640 tons of ammonium nitrate will be sold at auction at Nitrate Plant No. 2 on Oct. 27. The material is packed in barrels weighing 250 lb. each. About 40 per cent of the barrels will require repairs before they can be moved.

Duty Drawback Granted on Phenol and Sodium Nitrite

The Treasury Department has authorized drawback on the duty paid on imported sodium nitrite and phenol manufactured into sulphur blue dyes and exported by the Beaver Chemical Corporation, of Demascus, Va. The drawback is equivalent to 99 per cent of the duty paid on the imported commodities used in the exported finished products.

Smaller Output of Sole Leather

Production of sole leather in August totaled 1,164,317 sides, against 1,151,212 sides in July and 1,718,317 sides in August, 1923, according to preliminary Department of Commerce figures. Stocks in the hands of tanners Aug. 31 were 6,616,400 sides, compared with 7,111,776 sides July 31 and 8,861,918 sides Aug. 31, 1923. This makes the total reduction in stocks since the first of the year 2,400,000 sides.

News in Brief

Clark Chemical Plant Destroyed—The plant of the Clark Chemical Co. at Wickliffe, Ohio, was destroyed by fire on Sept. 27. Firemen were unable to do little more than watch the blaze. Exploding tanks of chemicals and gases prevented them from getting near the plant. Manufactures of the company included hydrogen, oxygen, nitric oxide, carbon dioxide and epsom salt.

Management Week Plans Are Extensive—Problems in budgeting for better office management will have the attention of some of the nation's keenest business minds during Management Week, Oct. 20 to 25, according to present reports. Committees in sixty-five of the most important cities of the United States and Canada are definitely planning to hold meetings that week devoted to management problems. The American Society of Mechanical Engineers, the American Management Association, the National Association of Cost Accountants, the Taylor Society and the Society of Industrial Engineers are co-operating in these meetings.

Foreign Engineers Honored—The presidents and governing boards of the four founder Engineering Societies gave an informal luncheon at the Engineers Club, New York, on Sept. 26 in honor of Sir Charles Morgan, president of the Institution of Civil Engineers; Sir Charles A. Parsons, Senatore Luigi Luiggi, president of the Italian Society of Engineers, and William H. Patchell, president of the Institution of Mechanical Engineers. More than eighty members and other outstanding engineers were present to meet the distinguished guests, who came to this country to attend the sessions of the recent centenary celebration of the Franklin Institute.

Ordnance Demonstration Held at Aberdeen—Exhibitions by the Ordnance Department, the Chemical Warfare Service, the Field Artillery, the Coast Artillery and the Air Service were featured at the sixth annual meeting of the Army Ordnance Association held at Aberdeen Proving Ground, Maryland, on Oct. 3. The American Institute of Chemical Engineers, the Institute of Makers of Explosives and the National Defense Section of the American Society of Mechanical Engineers participated.

Canadian Paper Exports Drop Slightly—The regular monthly report of the Canadian Pulp and Paper Association shows that exports of pulp and paper for the month of August were valued at $10,905,420, which was a decline of $460,021 from the month of July. The decline was due to smaller exports of paper, which dropped from $8,614,350 in July to $7,662,006 in August, while pulp exports increased in value from $2,751,091 to $3,243,414. For the 8 months of the year ended August the total value of exports of pulp and paper amounted to $91,393,867, compared with a total of $92,920,867 for the corresponding months of 1923.

Pulpstone Industry Promising in Northwest Canada—The manufacture of pulp stones in the Province of British Columbia promises to develop into a big industry. The J. A. & C. H. McDonald Co. is turning out some large stones, ranging in weight from 2 to 7 tons and valued at from $200 to $800 each. The rock from which the pulp stones are made comes from the company's quarries on Newcastle Island, near Nanaimo, and is said to be of exactly the peculiar quality required for pulpwood-grinding purposes.

Russian Bureau Formed for Textile Machinery Interests—A technical bureau for the manufacture of textile machinery has been formed in Russia in connection with the Metal Syndicate to deal with the question of supplies of machinery and equipment for the textile mills. Owing to the development of the textile industry a great demand has arisen for accessories and machine parts. It is proposed to found a company for the manufacture of card clothing, spindles, etc. In view of the great delay experienced in the execution of orders for textile accessories the question has arisen of importing from abroad a certain quantity of indispensable material, spindles, etc., on the condition that orders are given at the same time to Russian works.

Du Pont Changes in Personnel—The following changes have recently been effective at the Ashburn, Mo., plant of the Du Pont Co.; Paul Kaiser, assistant manager, was transferred to Repauno plant at Gibbstown, N. J., in the same capacity; H. O. Thayer, acid superintendent at Repauno, took Mr. Kaiser's place, while Art Skerry, of the Barksdale, Wis., plant, went to Repaune as acid superintendent. N. H. O. Brown, of Repauno, was transferred to Ashburn to replace P. S. Cushing, who filled Mr. Skerry's place.

W. C. Geer

Celotex Co. Expands Plant

The Celotex Co., Amesville, opposite New Orleans, La., manufacturer of wallboard products, utilizing bagasse, or waste sugar cane, as raw material, has acquired a tract of about 35 acres of land adjoining its present plant, making a total ground area of 80 acres for factory service. Plans have been authorized for the erection of a number of new buildings, for which it is expected to break ground at an early date. Machinery will be installed to increase the present output of 350,000 ft. per day to 1,000,000 ft., with additions to the working force to a total of 1,500 men.

Jersey Glass Makers Active

Glass plants at Millville, N. J., and vicinity are advancing operations following the usual summer decline, and a number of the plants expect to develop capacity production during October. The F. C. Wheaton Co., manufacturer of druggists' glassware, has started up at a number of furnaces, adding about 100 skilled workers to the force; fires will be lighted under the remaining furnaces of this organization within a week or so. The Whitall-Tatum Co., specializing in similar glassware, has also resumed production in a number of departments.

W. C. Geer Leaves Goodrich

After 17 years of service, Dr. W. C. Geer, vice-president in charge of research at the B. F. Goodrich Rubber Co., Akron, Ohio, has announced his intention of severing his official connection with the company some time during 1925, according to announcement. However, he states he will retain intimate connection with the company in a consulting capacity. He has several studies and developments of rubber that are nearing completion and expects to finish them during the next year while he still remains active in the company's management.

Dr. Geer expects to spend the next few years in travel and study along lines stimulated by his long connection with the scientific features of the rubber industry.

Goodrich officials attribute much of the development of rubber and its adaptation to both commercial and personal use to Dr. Geer. He has been responsible for many of the Goodrich products.

During the war Dr. Geer was frequently referred to as the "father of the gas mask," for his study helped develop the masks to safety and efficiency. He developed a number of other articles used by the government in the war.

His reputation has been country wide as a recognized authority in rubber chemistry. He is author of "The Reign of Rubber," an excellent contribution of literary and educational value.

Coming from Cornell University, where he held a professorship, Dr. Geer first became superintendent of development when he entered the services of the Goodrich Co. For the past 8 years he has directed the research work of the company.

Men You Should Know About

WARREN C. BRUCE, formerly with the Celite Products Co., has accepted a position as chemical engineer and director of research for the Feather-Stone Insulation Co., of Los Angeles. His work will have to do with the study of heat transfer relations and the use of diatomaceous earth for heat insulation, as filter aids and in other industrial applications.

SAMUEL J. CAPLAN has become chief chemist and works superintendent for Baum's Castorine Co., Rome, N. Y. Until recently Mr. Caplan was connected with the Waverly Oil Works Co., Pittsburgh, Pa., as chemist and assistant superintendent of the grease division.

WILDER A. CHAPMAN, who has been chemist for the D. L. & W. Railroad at Scranton, Pa., and who previously was a chemist with the Solvay Process Co. at Syracuse, N. Y., has joined the staff of Skinner, Sherman & Esselen, Inc., of Boston.

WILLIAM M. CORSE, of the National Research Council, was married Saturday, Sept. 20, to Ruth W. Albert.

L. A. DANSE, metallurgist of the Cadillac Motor Car Co., Detroit, Mich., gave an address, Sept. 19, before the members of the Detroit Engineering Society, on "A Few of the Metallurgical Aspects of the Automobile Industry," illustrated with a number of instructive lantern slides.

J. R. DOUGLAS, president and director of the Canadian Industrial Alcohol Co., Ltd., has resigned. Mr. Douglas in a letter to the board expressed his desire to take a prolonged holiday, and felt that it would not be possible for him under the circumstances to attend to the important duties of the president of the company. J. B. WADDELL, vice-president, was subsequently elected president.

Rear Admiral RALPH EARLE has been invited to become president of the Worcester Polytechnic Institute by the board of trustees, to succeed Dr. Ira N. Hollis, who tendered his resignation 2 years ago to become effective upon the choice of a successor.

Dr. G. J. ESSELEN, JR., of Skinner, Sherman & Esselen, Inc., of Boston, gave a series of lectures at the Harvard University Summer School, which recently closed, on "Recent Advances in the Physical Sciences of Interest to Teachers."

Dr. F. C. FRARY, director of research of the Aluminum Co. of America, has recently been called abroad on a short business trip.

CHARLES G. GIBSON, an official of S. Gibson & Sons, leather tanners, Leeds, England, has been elected Lord Mayor of that city for the ensuing year.

WALTER GOEBEL recently returned from Germany, where he has spent a year in graduate work at the University of Munich. On Sept. 25 he was appointed to the scientific staff of the Rockefeller Institute, New York City, to be engaged in chemical research.

RICHARD F. GRANT, vice-president of M. A. Hanna & Co., Cleveland, Ohio, and president of the Chamber of Commerce of the United States, gave an address before the members of the Philadelphia, Pa., Chamber of Commerce on Sept. 24.

JOHN L. GRAY has been elected vice-president and a director of the Shaffer Oil & Refining Co., with headquarters at Chicago, Ill. He has been active in the petroleum industry for more than 25 years, in both technical and executive capacities, having been associated with the Tidewater Oil Co., Pierce Oil Co. and the Barnsdall Refining Co. He will also act as general manager for the Shaffer Co.

H. W. HARDINGE, president of the Hardinge Co., Inc., returned recently from Europe, where he has been for the past 4 months on foreign business for the company. He sailed again Sept. 27 for England and the Continent on company business.

ARTHUR LAMB, an official of the Warren Paper Mills, with plants at Riegelsville, Finesville and Milford, Pa., and Warren, N. J., gave an interesting address before the members of the Rotary Club, Easton, Pa., Sept. 25, on paper manufacture and various kinds of paper.

JOSEPH R. MINEVITCH, a consulting chemical engineer of New York, returned Sept. 12, on the "Aquitania," from a 6 months trip through Russia, where he made a study of the Russian chemical industries.

H. C. PARMELEE, editor of *Chem. & Met.*, addressed the students of the department of chemical engineering at the University of Michigan, Ann Arbor, Mich., Sept. 30.

BERRY V. STOLL, vice-president, and William A. Stoll, treasurer of the Stoll Oil Refining Co., Louisville, Ky., have returned after a 2 months absence in Europe.

Professors in chemistry joining the faculty at Princeton University, Princeton, N. J., include M. A. Dietrich, R. T. Major, J. T. Mason, William H. Jones, J. D. Westerman, N. F. Myers, William B. Sesions, C. S. Sloat, Paul Robinson and S. B. Schofield.

Calendar

AMERICAN FOUNDRYMEN'S ASSOCIATION, Milwaukee, Wis., Oct. 11 to 16, 1924.

AMERICAN GAS ASSOCIATION. Steel Pier, Atlantic City, N. J., Oct. 13 to 17.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, Hotel Shenley, Pittsburgh, Pa., Dec. 3 to 6.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, Pasadena, Calif., Oct. 13 to 17.

AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS, Birmingham, Ala., Oct. 13 to 15.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS, New York, Dec. 1 to 4.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS, New York, Dec. 1 to 3.

ASSOCIATION OF OFFICIAL AGRICULTURAL CHEMISTS, Hotel Raleigh, Washington, D. C., Oct. 20 to 22.

EDWARD HART CELEBRATION AND INTERSECTIONAL MEETING OF AMERICAN CHEMICAL SOCIETY, Easton, Pa., Oct. 16 to 18.

MANAGEMENT WEEK. Auspices of American Society of Mechanical Engineers, New York City, Oct. 20 to 25.

NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING, Grand Central Palace, New York, Dec. 1 to 4.

SOUTHERN EXPOSITION, Grand Central Palace, New York, Jan. 19 to 31, 1925.

TECHNICAL ASSOCIATION OF THE PULP & PAPER INDUSTRY, Hotel Statler, Buffalo, N. Y., Oct. 14 and 15.

Obituary

ROBERT D. ANDERSON, inspector of mines and quarries for Nova Scotia, died suddenly at his desk in the Mines office on Sept. 22. He was in his sixty-fourth year.

E. H. FITCH, president of the Republic Tire & Rubber Co., Youngstown, Ohio, died at Hudson, Ohio, Sept. 20, after a long illness. He was 50 years of age. He was at one time owner and head of the Republic company, which later became a subsidiary of the Lee Tire & Rubber Co. He was a graduate of Cornell University.

Sir WILLIAM PRICE was killed Oct. 2 as the result of an accident at Kenogami, Que. Sir William and two engineers were engaged in inspecting work at Kenogami when a landslide occurred. Sir William was buried under the debris, but the engineers escaped.

WILLIAM HENRY SEARLE, inventor of machinery for the extraction of oil from cotton seed, died at the home of his daughter at East Orange, N. J., Sept. 24, aged 75 years. He was born in England and came to this country in 1884.

Canadian Mines Continue to Increase Production

According to a report just issued by the Ontario Department of Mines, the total value of mineral production in the province during the first 6 months of the current year was $37,997,776, an increase of $2,785,030 compared with the corresponding period in 1923. There was a marked increase in nickel-copper production, and the output of non-metallic minerals was well maintained. Clay products and structural materials, however, declined in valuation to some extent.

Sales of white arsenic declined 339,498 lb. Gypsum production declined by about 10 per cent. Natural gas production showed a small increase over 1923, due chiefly to conservation measures. There was an increase in crude petroleum production, but the value decreased. Salt marketed, classified according to grade, was: table and dairy, 20,878 tons; fine, 16,588 tons; coarse, 14,034 tons; land, 2,766 tons, and salt equivalent of brine used in chemical plants, 42,230 tons.

Larger Chemical Demand in September

Gain in Contract Withdrawals and in New Business—Vegetable Oils Affect Index Number

Withdrawals of chemical products against outstanding contracts were more consistent throughout September and showed a material gain in volume over the totals for August. This is accounted for by an increase in manufacturing lines and the consequent necessity for larger supplies of raw materials. Reports from the textile, rubber, leather, glass, and other trades indicated a moderate expansion in operations and the outlook for the final quarter of the year is regarded as favoring a continued increase in plant operations.

New business has improved since the summer period but has not reached a stage where it may be called active. Many companies are clinging to the policy of buying only for immediate requirements and trading in the spot market has been largely confined to moderate sized lots. The head of one of the large chemical companies states that the buyer, with the knowledge of market conditions and the improved transportation service, guaranteeing prompt delivery, has deferred purchases until material was actually needed.

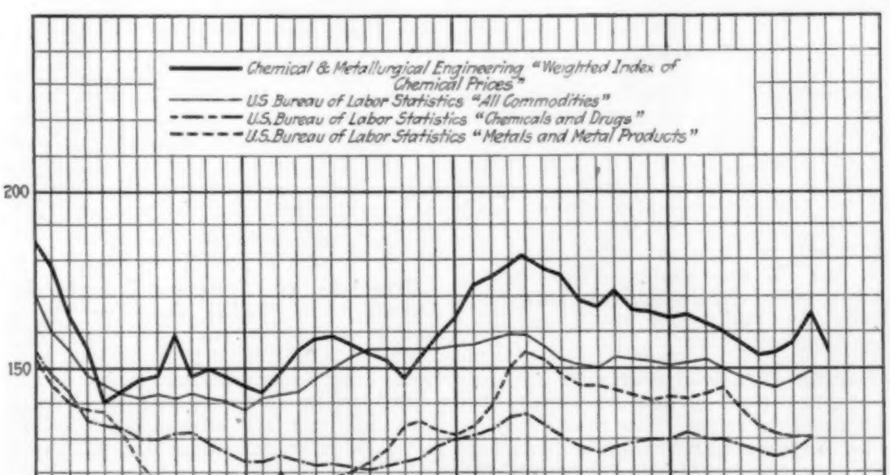
The weighted index number of *Chemical & Metallurgical Engineering* places the price average for chemicals and allied products in September at 154.72 as compared with 165.07 for August. This sharp decline was due almost entirely to fluctuations in the market for vegetable oils. These oils had advanced steadily in the three preceding months and lost these advances in September and thus offset the steady position held by the majority of the chemical commodities. As far as chemicals alone were concerned, price fluctuations were narrow. In a few cases, such as arsenic, calcium arsenate, citric and tartaric acids, the consuming season has passed and values have weakened under the falling off in demand. Other chemicals have held steady to firm and the trend, if anything, has been upward as concessions and sales at private terms have been harder to negotiate.

The Bureau of Labor reports a further upward movement of wholesale prices for August. The Bureau's weighted index number, which includes 404 commodities or price series, rose to 149.7 for August, compared with 147 for July and 150.1 for August, 1923. No change was made in the Bureau's weighted number for metals and metal products but chemicals and drugs advanced to 130.1 in August as compared with 126.5 in July. For August, 1923, the index number for chemicals and drugs was 127.4.

The status of nitrite of soda was more clearly defined in the past month by reason of a decision, refusing to grant an anti-dumping order against importations. The request for an anti-dumping order had been made by a domestic producer and while action was pending, it had served to check shipments from abroad. A decision also was handed down in the controversy on nitrate of soda with the result that refined nitrate was held to be entitled to free entry. On September 22 an automatic decrease in the import duty on coal-tars and dyes went into effect. This marked the end of the 2-year period of high protection granted to the domestic industry. It is too early to determine the effects of the lower duty but reports from Germany indicate that producers there expect to increase their sales of dyes in this country.

Glauber Salt Combination in Germany Dissolved

The Kaiseroda Gewerkschaft has withdrawn from the German Glauber Salt Convention and immediately thereafter began offering sodium sulphate at a price 30 per cent below the convention price. This has had the effect of breaking up the convention. Even that price, however, will not enable the German manufacturers to compete in foreign markets, as the British f.o.b. cost is materially less.



Trade Notes

The Italian Electrochemical Co. is expanding its operations and has increased its capital from 21 million lire to 41 million lire. The company manufactures electrolytic soda, aluminum, cellulose and hydrogen.

Dr. Maximilian Toch, vice-president of Toch Brothers, Inc., returned from Europe on the "Leviathan" on Sept. 22. He left New York last February at the invitation of the Chinese Government, having been appointed honorary professor of chemistry, to deliver a series of lectures at the Peking Technical College at Peking.

At the annual meeting of the Wood Chemical Association, held in Buffalo, W. Z. Georgia was elected president, W. H. Matthews vice-president, and F. J. Goodfellow secretary and treasurer.

Judge Runyon, in the U. S. District Court, Newark, N. J., last week authorized receivers of the Southern Cotton Oil Co., subsidiary of the Virginia Carolina Chemical Co., to resume operations in thirty cottonseed crushing mills, thirty-two cotton ginneries and seven peanut shelling plants, all owned by the cotton oil company in Southern States.

Chemical Equipment Makers Hold Annual Meeting

The second annual meeting of the Association of Chemical Equipment Manufacturers—commonly known as the C.E.A. or the Chemical Equipment Association—held at the Chemists Club, New York City, Tuesday, Sept. 16, resulted in the election of G. O. Carter, Linde Air Products Co., president; E. C. Alford, T. Shriver & Co., T. C. Oliver, Chemical Construction Co., and L. S. Thurston, General Electric Co., vice-presidents; P. S. Barnes, the Pfaudler Co., treasurer, and Peirce D. Schenck, Duriron Co., Inc., and J. W. Spotten, United Lead Co., directors for 3 years.

This makes the present board of directors comprise: Peirce D. Schenck, J. W. Spotten, Harlowe Hardinge, Hardinge Co.; P. B. Sadtler, Swenson Evaporator Co., H. N. Spicer, the Dorr Co., and R. Gordon Walker, Oliver Continuous Filter Co.

Definite and gratifying progress along each line of activity undertaken by the association was reported by the various officers and committee chairmen. The outstanding committee report was that of the exposition committee, comprising G. O. Carter, Linde Air Products Co.; E. C. Alford, T. Shriver & Co., and Roberts Everett, secretary of the association, in charge of plans for the First Chemical Equipment Exposition to be held in Providence June 22 to 27 inclusive, 1925.

In commenting upon the development of the association's activities in its second year, President Oliver pointed out that they are "not directed at the general public, but to the men in chemical and chemically controlled industry."

Market Conditions

Firm Markets Abroad Steady Values for Imported Chemicals

Combinations Among Foreign Producers a Factor in Stabilizing Prices—Recovery in Cottonseed Oil Causes Advance in Index Number

COMBINATIONS among producers of chemicals in foreign countries have had the effect of firming up values and recent cables have quoted higher prices for shipments and likewise had a tendency to stiffen values for foreign chemicals in the spot market. The agreement reached by German and French producers has eliminated competition in potash salts and the latter are now quoted on a uniform basis with American consumption taken care of by allotment.

Producers of caustic potash in Germany were reported to have entered into a working agreement a short time ago and prices for this material were firmer last month and the market continued to harden in the past week. Producers of copper sulphate in Great Britain recently formed an association with a view of increasing export business in that chemical. Offerings of foreign sulphate last week were reported to be limited and shipment prices were higher. As an exception to the general rule, advices from Germany stated that the combination among producers of glaubers salt in that country had been broken and prices were lowered as a result of the competition which developed.

The weighted index number for the week was 153.61, which compares with 151.31 for the preceding week. The advance was attributed largely to rises in the cottonseed oil market but was aided by firmer markets for miscellaneous selections in the chemical group.

The fact that new contract prices for alkalis have not been announced has caused considerable discussion in the trade and various rumors have arisen to account for the delay. Some producers have admitted that the subject has been under consideration for some time but evidently developments in general industrial lines have been awaited. It is expected that the new prices will be named in the near future. In the meantime a steady call is reported for alkalis against old contracts.

The metal markets of late have worked into an easier position and the salts have reflected this condition.

Acids

The marked decline in demand for imported citric and tartaric acids which has featured the market in recent weeks is exemplified by the fact that imports of citric acid in August were but 448 lb. as compared with 67,100 lb. in August last year, while imports of tartaric acid declined to 88,632 lb. as compared with 119,696 lb. in August last year. Prices for these acids reflect the loss in consumer buying and tartaric is reported to have sold at 25½c. per lb. Imported oxalic acid continues to compete keenly in domestic markets and imports in August were 247,516 lb. as compared with 160,402 lb. in August, last year. Acetic acid has been moving more freely and sellers are said to have reduced surplus holdings. Mineral acids continue to find an increasing outlet. The lower grades of sulphuric acid have been in demand by makers of fertilizers and call from various industries has reduced stocks of all strengths and given a steadier tone to prices. Nitric and muriatic acids also have sold more consistently for both prompt and later shipments.

October Deliveries of Tin Salts at Lower Prices—Arsenic Sells at Reduced Levels—Imported Caustic Potash Higher—Bichromates Steadier—Denatured Alcohol Firm—Prussiates Quiet—Contract Prices for Alkalis Deferred—Mineral Acids Move Firmly

Potashes

Bichromate of Potash—Export demand has suffered in comparison with that for last year as outward shipments for the 8 months ended August were 757,838 lb. as compared with 2,419,808 lb. for the corresponding period last year. Export inquiry was heard last week but call was for small lots and 8¾c. per lb. was quoted. This figure also is named for domestic business but stocks are said to be small and the tone appears firmer.

Caustic Potash—Imports in August were 570,791 lb. as against 760,149 lb. in August, last year. For the 8 months ended August, imports were larger than last year, the totals being 7,426,165 lb. and 6,721,652 lb. respectively. The market has been firmer and spot caustic was quoted last week at 7c. per lb. Bids under that were said to have gone unaccepted. Shipments from abroad were quoted at 6¾@7c. per lb.

Permanganate of Potash.—Demand has been slow and prices have been irregular and depended on seller. Spot material was held at 13½c. per lb. in some quarters but offerings under 13c. per lb. were said to be available and prices appeared to be a matter of private negotiation.

Prussiate of Potash—Yellow prussiate has continued inactive and only small lots have interested buyers. Quotations for spot material are generally given at 17½c. per lb. but this figure is largely nominal and recent sales are said to have been around 17c. per lb. Forward positions are not meeting with much inquiry and 16½@17c. per lb., according to seller, represents the quoted prices.

Sodas

Bichromate of Soda—Some sellers are said to be carrying small stocks and production has declined in some quarters because of the low prices which have been ruling. The market is now quoted as firm at 6¾@7c. per lb., according to seller.

Caustic Soda—Exports in August were 6,872,574 lb. This makes a total of 59,849,991 lb. for the 8 months ended August as compared with 79,596,084 lb. for the corresponding period of last year. New contract prices for next year have not yet been named and the delay is arousing interest among consumers. Sales for domestic account are reported to have been made at 2.90c. per lb. but the contract price still holds at 3.10c. per lb. Export inquiry was quiet with material offered at 2.85c. per lb. f.a.s.

Nitrate of Soda—A report from Chile says that production of nitrate continues on a large scale with correspondingly important sales. During the past month 3,035,000 metric quintals were sold and foreign demand continues strong. Domestic markets have been featured by keener competition and new factors are reported to have sold at low prices in Southern markets. Prices have been easier in all positions and spot nitrate has been offered at $2.40@$2.42½ per 100 lb. both in the North and in the South.

Prussiate of Soda—Imports in August were 218,524 lb. For the 8 months ended August imports were 2,020,632 lb. and 852,048 lb. in 1924 and 1923 respectively. Present buying is reported to be for moderate sized lots. Spot holdings are offered at 9⅛@9¼c. per lb. with shipments at 8¾c. per lb.

Miscellaneous Chemicals

Acetate of Lime—Production of acetate of lime in July fell off sharply with a total of 7,479,000 lb. Ship-

ments were also small, amounting to 6,314,000 lb. Stocks on hand at the end of July were 22,657,000 lb. as compared with 32,291,000 lb. at the beginning of that month. This would indicate a large consumption at producing centers. Exports in August were 727,709 lb. thus giving a total of 14,844,854 lb. for the 8 months ended August as compared with 18,620,691 lb. for the corresponding period, last year. Prices are unchanged at $3 per 100 lb.

Arsenic—Some holders of spot material were forcing sales last week and imported arsenic was reported to have sold at 6c. per lb. This was not a general quotation, in fact these were described as distressed lots. Japanese arsenic on spot was offered at 6½c. per lb. European was held at 7c. per lb., on spot, and at 6¾c. per lb. for shipment. Domestic arsenic was reduced to 7c. per lb. for large quantities. Imports of arsenic in August amounted to 570,970 lb. For the 8 months ended August, imports were 14,267,807 lb. as compared with 13,049,902 lb. in the corresponding period of 1923.

Barium Chloride—Only moderate interest was reported for this chemical and spot material was freely offered at $73 per ton. Shipments from abroad were quoted at $71 per ton. Barium carbonate was offered at $55 per ton. on spot, with shipments at $54 per ton.

Copper Sulphate—Offerings from foreign markets were reported to be limited and cables quoted shipments at 4¾@4½c. per lb. which represents an advance during the period. Domestic sulphate was quiet with quotations at 4.40@4.65c. per lb., at works, the range depending on seller and grade. Imports of sulphate in August are officially reported at 99,257 lb.

Formaldehyde — While reports are still heard to the effect that carlots can be bought under 9c. per lb., the latter price is quoted by some of the prominent factors. In fact the open quotation is 9c. per lb. and there is some doubt about the veracity of reports at lower prices.

Fusel Oil—Recent inquiry for crude fusel oil has emphasized the fact that stocks are small. Prices are firm in view of the limited supply and sellers ask $3.25@$3.50 per gal. Refined also in small supply and prices are said to depend on seller with $3.50@$4 per gal. representing the market.

Sal Ammoniac — Interest has been sustained in imported white sal ammoniac by the activity of sellers. Spot holdings were offered at 6c. per lb. with shipments from foreign points at 5¾c. per lb. Gray sal ammoniac was quoted at 7½@7¾c. per lb.

Tin Salts — The average price for Straits tin in September was 49,095c. per lb. This lower level for the metal brought out lower prices for the salts for October delivery. The new prices quote bichloride of tin at 13¾c. per lb., tin crystals at 35c. per lb., tetrachloride of tin at 28c. per lb., and tin oxide at 52c. per lb.

Zinc Oxide—With no important change in prices for the metal the market for oxide was maintained at 7¾c. per lb. on the American process, lead free, carload basis. The rubber trade has been taking larger quantities.

"Chem. & Met." Weighted Index of Chemical Prices

Base = 100 for 1913-14

This week	153.61
Last week	151.31
Oct., 1923	167.00
Oct., 1922	153.00
Oct., 1921	151.00
Oct., 1920	263.00
Oct., 1919	233.00
Oct., 1918	280.00

Major items in the chemical division did not change much one way or the other, but a sharp upturn in cottonseed oil raised the weighted index number 230 points.

Alcohol

Producers reported a firm situation in denatured alcohol, but no price changes were announced in the past week. Basic materials made further gains, while the volume of business was up to normal. Completely denatured, formula No. 5, held at 49c. per gal., in drums, carload basis. Special, formula No. 1, was maintained at 50c. per gal., in drums.

Methanol was steady at former prices. Production in July amounted to 396,902 gal., which compares with 492,902 gal. in June and 652,955 gal. in July a year ago. On the 97 per cent grade of methanol producers held out for 76c. per gal., in barrels, carload lots.

Coal-Tar Products

Production of Crudes Moderate and Prices Generally Steady—Better Call for Phenol—Creosote Oil Imports Increase

THE gain in production of byproduct coke has not yet made sufficient headway to result in any accumulation of supplies. First hands report moderate stocks of benzene and other basic materials. Sulphate of ammonia output appears to be sold up and spot prices are little more than nominal. The continued weakness in gasoline brought out some uneasiness among sellers of motor fuel grades of benzene, but the 90 per cent and pure grades remained comparatively steady. There was a fair amount of buying interest in phenol for immediate as well as nearby delivery and prices ruled firm, though quotably unchanged. Naphthalene was offered at former prices. The demand for aniline oil was good, reflecting improved conditions in the consuming trades. Ortho-toluidine was firmer on steady buying for immediate delivery. Import statistics for the month of August revealed a heavy movement of creosote oil into this country, the arrivals amounting to 10,417,622 gal., which compares with 3,586,488 gal. for August 1923. Advices received here in the past week reported quiet trading in coal-tar products in nearly all of the British markets, with the undertone rather heavy.

Aniline Oil and Salt—Orders for aniline oil have been more numerous and with supplies moderate, due to restricted production, the undertone of the market remains quite firm. Producers maintained the selling basis at 16c. per lb., drums extra, carload lots, shipment from works. Aniline oil for red held around 40c. per lb. Aniline salt was inactive, with sellers at 20@22c. per lb., as to quantity, etc.

Benzene—Demand for 90 per cent benzene was fair. Offerings were moderate at all times and a steady undertone featured the market. On the motor fuel grades prices have been less favorable from the producers' standpoint, because of the continued weakness in the petroleum product. Exports of benzene during the month of August, according to official statistics, amounted to 5,823,443 lb., which compares with 4,544,270 lb. in August a year ago. The market for the 90 per cent grade held at 23c. per gal., with the pure at 25c. per gal., in tank cars, f.o.b. works.

Beta-naphthol — Inquiry was moderate, but prices ruled steady, leading producers demanding from 24@26c. per lb., the inside figure obtaining on round lots, f.o.b. works.

Creosote—Offerings from abroad liberal in quantity and prices again were unsettled, favoring buyers. Manchester reported offerings of creosote oil for prompt shipment from works, in bulk, at 5¼@5½d. per gal.

Cresylic Acid—Some traders were inclined to ask higher prices, but in general quotations on the 97 per cent grade held at 63@68c. per gal., according to color, etc. On the 95 per cent material there were sellers at 58@61c. per gal.

Naphthalene—Importations of crude naphthalene in the month of August amounted to 263,988 lb., which compares with 963,775 lb. in August a year ago. Because of the quiet condition of trade in this product stocks have accumulated and this has discouraged importing. Offerings of refined white flake were reported at 4½@5c. per lb. Chips held nominally at 4@4½c. per lb. Crude to import was available around 2c. per lb., c.i.f. New York.

Ortho-toluidine—There was a steady inquiry for spot and nearby material and prices ruled firm at 14@15c. per lb., according to seller.

Phenol—Business was reported during the week at prices showing no change, small lots being available for immediate delivery at 25@26c. per lb., in drums. One producer offered phenol in large drums at 24c. per lb. Offerings were smaller and the undertone was quite firm.

Pyridine—With no change in foreign markets operators here continued to quote the market firm at $4.30@$4.50 per gal. Supplies were restricted to rather small parcels as importations have not been heavy in the past month or so. Pyridine for future delivery was nominal at $4.25 per gal.

Vegetable Oils and Fats

Sharp Recovery in Prices for Cottonseed Oil—Linseed Oil Futures Advance—Crude Corn Oil Up—Tallow Higher

UNFAVORABLE crop news had a bullish affect upon the market for vegetable oils and fats. Speculative activity in cottonseed oil broadened, heavy buying for Chicago operators sending prices sharply higher. The premium now obtaining on pure lard inspired much of the business. Flaxseed at Duluth was strong on the general uplift in grains, and, late in the week crushers announced higher prices for linseed oil for future delivery. Advances also took place in crude corn oil, china wood oil, palm oil, tallow and greases. Soap makers entered the market for tallow in a fairly large way.

Cottonseed Oil—Higher lard, together with less favorable news on the cotton crop, inspired heavy trading in the option market for refined cottonseed oil. Offerings of seed were smaller at an advance of about $10 per ton from the recent low. This, in turn, resulted in smaller offerings of crude oil throughout the South, and added to the bullish developments. There was some selling on the bulge by refiners, who acted on the belief that crude oil pressure should come along in the near future. Most of the buying orders for refined oil originated in the West. Prime summer yellow oil for October delivery sold at 11c. per lb., in bbl., which compares with 9.76c. asked a week ago. December oil advanced to 10.80@10.84c., with January at 10.94c. per lb. Crude oil sold at 9c. per lb., tank cars, f.o.b. mills, Southeast, a net gain of 1c. per lb. for the week. In Texas the market for crude was nominal at the close at 9c. per lb., tank car basis. Cottonseed was nominal at $40 per ton f.o.b. mills. Lard compound was in better demand and first hands raised prices to 13¼@13½c. per lb. Pure lard on spot was scarce. On Thursday the Chicago lard market closed firm with cash at 14.62c. per lb., and December at 14.27c. per lb. Stocks of pure lard in the Chicago district on Oct. 1 amounted to 50,186,985 lb., which compares with 74,429,585 lb. on Sept. 1, and 37,092,883 lb. a year ago.

Linseed Oil—Quotations named on futures were fully 4c. per gal. higher compared with a week ago. The price of October oil was raised 2c. per gal. The advance did not take place until Thursday. Just before the higher market became general some crushers booked quite a little business, good orders going through on deliveries extending into the first quarter of 1925. Sales of January-March oil were reported at 88@89c. per gal., cooperage basis. Late in the week January forward was maintained by leading sellers at 92c. per gal., cooperage basis. November-December settled nominally at 93c. per gal., with November alone at 94c. per gal. Early October delivery was firm at 98c. per gal., with late October at 96c. per gal., cooperage included, carload lots. The seed markets in the Northwest advanced 14c. per bu. in the past week, due in part in active buying for crushers. The strength in other grains had a bullish influence, for adverse weather conditions brought out a general advance in prices. The flaxseed situation at Duluth attracted attention. A rail embargo on shipments into Duluth caused confusion and crushers in need of supplies were put to some inconvenience. Any delay in shipments of seed will restrict production of oil. Developments in the Argentine were unfavorable. The area sown to flaxseed is estimated to be 8 per cent larger than a year ago, but dry weather has ruined much of the seeding and it is reported that close to 30 per cent of the area has been abandoned. The Buenos Aires market ruled firm, October seed settling around $2.07½, with February shipment (new crop) nominal at $1.92 per bu. Duluth quoted October seed at $2.43½, and December at $2.39 per bu. Linseed cake for export steady at $46.50@$47 per ton, f.a.s. New York.

Gain in Imports of Oilseeds Into United Kingdom

With the exception of cottonseed and soya beans importations of oilseeds into the United Kingdom show a substantial increase. Import statistics for the 8 months ended Aug. 31, with a comparison, follow:

	1924	1923
Castor, ton	17,605	9,745
Cottonseed, ton	341,948	366,080
Linseed, ton	319,182	286,360
Rapeseed, ton	61,906	45,945
Sesame, ton	8,576	2,990
Soya, ton	78,633	106,125
Copra, ton	57,792	51,608
Peanuts, ton	90,772	83,940
Palm kernels, ton	191,367	163,482
Other sorts, ton *	49,762	33,242

* Including sunflower.

China Wood Oil—Offerings scanty and prices higher. Spot oil, in bbl., New York, 16½@17c. per lb. On the coast 15½c. per lb. was bid on tank cars for October shipment.

Coconut Oil—There was some inquiry from soap makers and prices steadied. Ceylon type oil for shipment from the coast held at 8¾c. per lb., tank car basis, all positions. In New York 9¼@9½c. represented open quotations.

Corn Oil—Crude corn oil sold at 9c. early in the week, but later bids at 9¼c. were turned down.

Other Vegetable Oils—Lagos palm oil was higher abroad and traders here raised their views to 8⅝@8¾c. on spot material. Genuine Lagos for October shipment from abroad 8⅜@8½c. per lb. Niger palm oil for October-December shipment from abroad 7.85c. per lb. Refined rapeseed oil for October forward shipment from English ports advanced to 95c. per gal., with the market excited. Prime green olive oil foots nominal at 9¼@9½c. per lb., immediate delivery. Mixed crude soya 10⅜c. per lb., duty paid, tank cars, Pacific coast ports.

Fish Oils—Because of poor fishing one of the largest factors in crude menhaden oil went into the hands of a receiver. The market for crude oil remained nominal around 50c. per gal., tank cars, fish factory. Tanked Newfoundland cod oil held at 62@63c. per gal.

Tallow, Etc.—Soap makers were heavy buyers of extra special tallow at an advance in price, business passing at 8⅜@8½c. per lb. Late in the week 8¾c. was asked. Yellow grease was raised to 7⅛@7⅝c. per lb. Oleo stearine sold at 11½c., and later 12c. was asked.

Miscellaneous Materials

Antimony—Demand was slow at the higher prices and this brought out an easier feeling in some quarters. Chinese and Japanese brands closed at 11⅛@11¼c. per lb. Cookson's "C" grade steady at 13¼@13½c. per lb. Chinese needle, lump, nominal at 8½@8¾c. per lb. Standard powdered needle, 200 mesh, 9@10c. per lb. White oxide, Chinese, 99 per cent, 12@13c. per lb.

Barytes—Operations are estimated at 70 per cent of normal. Stocks on hand fairly large. Prices, however, underwent little change. Crude $8.50 per ton, Missouri mines, 90@98 per cent $BaSO_4$; $9 per ton, f.o.b. Georgia mines; $6@$8, at Baltimore. Ground—Off color, $13 per ton, Baltimore; white, $17, Baltimore. Water ground and floated, bleached, $23@$24, f.o.b. St. Louis.

Glycerine—Dynamite glycerine was slightly easier, offerings appearing on the market at 18¼c. per lb., drums included, f.o.b. point of production in the Middle West. Demand has been less active. Chemically pure was nominally unchanged 19c. per lb., in drums, f.o.b. New York territory, while in the Middle West there were sellers at 18½@18¾c. per lb. Soap lye crude, basis 80 per cent, was lowered at 12c. per lb., loose.

Lithopone—Producers reported an irregular market on deliveries extending over a protracted period, competition being quite keen. Prices heard during the week ranged from 5¾@6c. per lb., in bags, carload lots.

Naval Stores—Trading was along routine lines and prices scarcely changed, either here or in the South. Spirits of turpentine sold at 87c. per gal., in bbl., ex store, New York. Rosins were firmer, the lower grades settling at $6.25@$6.35 per bbl.

Shellac—Bleached shellac was offered sparingly on spot and prices were quite firm at 70@72c. per lb. T.N. also was firm, reflecting higher values at primary centers, and most sellers now quote 62c. per lb. Superfine orange was available at 65@66c. per lb. Demand has improved.

White Lead—The movement of white lead into consuming channels remains good and a fairly steady undertone prevails in all directions. With pig lead holding at 8c. per lb., and no change in the acetic acid situation, corroders expect prices to hold. Standard dry white lead, in bbl. or casks, was traded in at 10c. per lb., carload lots.

Imports at the Port of New York

September 26 to October 2

ACIDS—**Coal-tar**—20 bbl., Hull, Merck & Co. **Tartaric**—50 csk., Rotterdam, W. Benckert & Co.

ALBUMEN — 36 cs., Shanghai, D. L. Moss & Co.; 107 cs., Shanghai, Stein, Hall & Co.; 49 cs., Shanghai, French, Kreme Co.; 20 cs., Shanghai, Seral Trading Co.; 56 cs., Shanghai, A. Klipstein & Co.; 49 cs., Shanghai, Importers Comm. Co.; 30 cs., Shanghai, Order.

ALCOHOL—250 bbl. denatured, Arecibo, C. Estevas.

AMMONIUM NITRATE—179 csk., Hamburg, Kuttroff, Pickhardt & Co.

ANTIMONY OXIDE — 100 bg., Newcastle-on-Tyne, Order.

ANTIMONY REGULUS — 500 cs., Shanghai, Standard Bank of South Africa.

ANTIMONY SULPHIDE—186 csk., Newcastle-on-Tyne, S. Fullwood.

ARSENIC — 300 cs. refined, Tokyo, Meteor Products Co., 20 csk. sulphide, London, L. H. Butcher Co.

BARIUM CHLORIDE — 99 bbl., Hamburg, Mechanics & Metals National Bank; 142 csk., Rotterdam, Order.

BARYTES—80 csk., Hamburg, A. Hurst & Co.; 155 bg., Hamburg, L. A. Salomon & Bros.; 500 bg., Bremen, New York Trust Co.; 62 csk., Rotterdam, A. Grantoff.

BLANC FIXE—2 csk., Hamburg, E. M. & F. Waldo.

BRONZE POWDER — 11 cs., Bremen, Order.

CALCIUM CHLORIDE—157 dr., Hamburg, Coal & Iron National Bank.

CAMPHOR — 200 cs. crude, Shanghai, Hetherman & Co.; 500 cs. refined, Kobe, Suzuki & Co.; 89 csk., Hamburg, Order.

CASEIN—417 bg., Buenos Aires, West Virginia Pulp & Paper Co.; 885 bg., Buenos Aires, Kalbfleisch Corp.

CARBON—20 bg. decolorizing, London, C. Pfizer & Co.

CHALK—500 tons (in bulk), London, Taintor Trading Co.; 500 tons, London, Baring Bros. & Co.; 100 bg., London, C. B. Richard & Co.; 834,000 kilos, Dunkirk, Taintor Trading Co.

CHEMICALS—274 bg., Glasgow, Brown Bros. & Co.; 45 carboys, Rotterdam, Order; 250 bg., Rotterdam, P. Uhlich & Co.; 10 dr. and 36 cs., Hamburg, Elmer & Amend; 10 cs., Hamburg, G. Gennert, Inc.; 7 cs. and 23 csk., Hamburg, Pfaltz & Bauer, Inc.; 34 cs., Hamburg, Order; 26 cs., Havre, G. J. Wallace, Inc.; 52 csk., Rotterdam, Roessler & Hasslacher Chem. Co.; 10 csk., Rotterdam, R. W. Greeff & Co.; 250 bg., Rotterdam, P. Uhlich & Co.; 133 csk., London, Toch Bros.; 13 bbl., Hamburg, Order; 426 bbl., Hamburg, Roessler & Hasslacher Chem. Co.; 600 bg., Bremen, Order; 38 dr. and 12 csk., Rotterdam, Order; 448 cs. products, Havre, International Banking Corp.

CHLORIDE LIME—109 dr., Hamburg, E. Suter & Co.

COAL-TAR DISTILLATE — 100 bbl., Hull, Merck & Co.

COLORS—7 csk. aniline, Hamburg, H. A. Metz & Co.; 8 cs. aniline, Genoa, Ackerman Color Co.; 51 dr., Havre, Sandoz Chemical Works; 4 csk. aniline, Havre, Carbic Color & Chem. Co.; 69 csk. do., Havre, Ciba Co.; 21 csk. do., Rotterdam, H. A. Metz & Co.; 48 csk. do., Rotterdam, Kuttroff, Pickhardt & Co.; 124 csk. and 1 cs. aniline, Rotterdam, Grasselli Dyestuff Corp.; 8 csk. do., Rotterdam, American Exchange National Bank.

DEXTRINE—100 bg., Rotterdam, Spier, Simmons & Co.

DIVI-DIVI—750 bg., Pampatar, R. Desvernine.

EPSOM SALT—400 csk., Hamburg, Innis, Speiden & Co.

FERROCOBALT—8 cs. cubes, Liverpool, De Courcy Browne.

FUSEL OIL — 10 bbl., Hamburg, Schenkers, Inc.; 19 dr., Antwerp, Wilbeck Chemical Corp.

FORMALDEHYDE HYDROSULPHITE—36 cans, Havre, Intl. Mercantile Marine Co.

GLYCERINE—20 dr. crude, Marseilles, Order; 20 dr. crude, Hamburg, Order; 48 csk., Barcelona, Order.

GRAPHITE — 94 bg., Havre, International Ore & Metal Selling Corp.

GUMS—250 bg. and 3 cs. copal, Manila, Chartered Bank of India, Australia and China; 200 bg. copal, Antwerp, Hale & Son; 59 bg. damar, London, Winterbourne & Co.; 30 cs. tragacanth, London, Order; 200 cs. damar, Batavia, Order; 192 bg. do., Singapore, Brown Bros. & Co.; 58 bg. tragacanth, London, Thurston & Braidich.

IRON OXIDE—25 csk., Liverpool, J. A. McNulty; 69 csk., Liverpool, Reichard-Coulston, Inc.; 4 csk., London, Interstate Chemical Co.; 250 bbl., Malaga, C. J. Osborn Co.; 218 bbl., Malaga, Reichard-Coulston, Inc.; 80 bbl., Malaga, J. Lee Smith & Co.; 46 bbl., Malaga, L. H. Butcher & Co.; 166 bbl., Malaga, Order.

Opportunities in the Foreign Trade

Parties interested in any of the following opportunities may obtain all available information from the Bureau of Foreign and Domestic Commerce at Washington or from any district office of the bureau. The number placed after the opportunity must be given for the purpose of identification.

BORAX. Cologne, Germany. Purchase.—11,757.

CARBON BLACK. Hamburg, Germany. Agency.—11,724.

FERTILIZERS. San Jose, Costa Rica. Purchase.—11,756.

GLUE, VEGETABLE. Vienna, Austria. Purchase.—11,774.

PAINTS AND VARNISHES. Shanghai, China. Agency.—11,746.

POTASH AND CAUSTIC SODA. Bahia, Brazil. Agency.—11,726.

ROSIN. Sydney, Australia. Agency.—11,727.

ROSIN AND ROSIN OIL. Dundee, South Africa. Purchase.—11,755.

SODA, CAUSTIC. Bahia, Brazil. Agency.—11,729.

SODA, CAUSTIC. Amritsar, India. Purchase and agency.—11,763.

WAXES, beeswax, cresin, and carnauba. Sydney, Australia. Agency.—11,727.

CASEIN, ALBUMINOUS. Vienna, Austria. Purchase.—11,774.

CORN OIL, vulcanized. Hamburg, Germany. Purchase.—11,717.

IRON SULPHATE—49 bbl., Hamburg, Farmers Loan & Trust Co.

LAMP BLACK—30 csk., Rotterdam, A. Hurst & Co.

LITHOPONE — 20 csk., Antwerp, A. Klipstein & Co.

MAGNESIUM CHLORIDE — 3 dr., Southampton, Lenyon & Morant; 72 dr., Hamburg, Order.

MAGNESIUM METAL—2 cs., Hamburg, Order.

MAGNESITE — 226 csk., Rotterdam, Speiden, Whitfield Co.

MENTHOL — 5 cs. synthetic, London, McKesson & Robbins.

MYROBALANS — 1,703 pkts., Calcutta, Order; 5,360 bg., Calcutta, National City Bank; 538 pkts., Calcutta, Order.

OCHER—25 bbl. Alicante, F. B. Vandegrift & Co.

OILS—**Cod**—80 csk., Halifax, Cook & Swan Co.; 152 csk., St. Johns, Franklin Agencies, Ltd.; 250 csk., St. Johns, National Oil Products Co.; 390 csk., St. Johns, R. Badcock & Co. **China Wood**—145 bbl., Shanghai, American Linseed Co.; 150 bbl., Shanghai, Bank of America; 10 csk., Hankow, Jardine, Matheson & Co.; 60 bbl. Hankow, Mitsui & Co.; 420 bbl., Hankow, Order; 12 csk., Shanghai, Mac Andrews & Forbes Co. **Fish**—205 bbl., Aberdeen, Order. **Olive foots** (sulphur oil)—250 bbl., Piraeus, Order. **Palm kernel**—45 csk. crude, Hull, Order; 118 dr., Liverpool, Order. **Palm**—30 bbl., Liverpool, Order; 53 dr., Liverpool, Order; 437 csk., Rotterdam, Order. **Peanut**—200 cs., Hong Kong, Kwong Mee Yuen. **Rapeseed**—780 bbl., Hull, Order; 50 bbl., London, W. B. Dick & Co. **Sperm**—200 bbl., Glasgow, Order. **Sesame**—150 bbl., Copenhagen, Order.

OIL SEEDS—**Castor**—2,234 bg., Pernambuco, Order; 24 bg., Port de Paix, Huttlinger & Struller; 42 bg., Port de Paix, J. L. Hachtmann & Co.; 24 bg., Port au Prince, S. L. Brinley; 9,560 bg., Coconada, Volkart Bros.; 9,862 bg., Bombay, Volkart Bros. **Sesame**—800 bg., Shanghai; Wah Chang Trading Co.

PITCH—102 bbl. stearine, Manchester, A. Hurst & Co.; 111 bbl., Hamburg, Order; 49 bbl., Liverpool, Order.

POTASSIUM SALTS— 160 bbl. nitrate, Rotterdam, Superfos Co.; 40 csk. alum, Hamburg, Order; 1,500 csk. chlorate, Hamburg, Irving Bank-Col. Trust Co.; 600 bbl. chlorate, Hamburg, E. Suter & Co.; 12 csk. prussiate, Antwerp, Mechanics & Metals National Bank; 363,035 kilos manure salt, Hamburg, Potash Importing Corp. of Am.; 1,050 csk. chlorate, Hamburg, Seaboard National Bank; 90 cs. caustic, Gothenburg, Mallinckrodt Chemical Works; 23 kegs prussiate, Liverpool, Order; 18 csk. caustic, Bremen, Order; 50 dr. permanganate, Hamburg, Innis, Speiden & Co.; 500 cans chlorate, Havre, C. Hardy, Inc.

PYRIDINE—12 dr., Hamburg, R. W. Greeff & Co.; 11 dr., Hamburg, Order

QUICKSIVER — 100 flasks, London, Order.

SAL AMMONIAC — 76 bbl., Hamburg, Order; 299 csk., Rotterdam, Kuttroff, Pickhardt & Co.

SHELLAC—210 cs., Bangkok, Order; 330 bg., Calcutta, Marx & Rawolle; 2,268 pkg., Calcutta, Order; 32 bg., Hamburg, Irving Bank-Col. Trust Co.; 131 cs. garnet, Hamburg, Order.

SOAPSTONE—750 bg., Bordeaux, Whittaker, Clark & Daniels; 400 bg., Bordeaux, L. A. Salomon & Bros.

SODIUM SALTS—134 dr. sulphite, Rotterdam, C. S. Grant & Co.; 50 cs. bromide, Hamburg, Order; 156 dr. sulphite, Hamburg, C. S. Grant & Co.; 19 csk. fluoride, Hamburg, Mechanics & Metals National Bank; 132 dr. sulphohydrate, Rotterdam, C. S. Grant & Co.; 42 csk. fluoride, Rotterdam, Innis, Speiden & Co.; 60 cs. cyanide, Liverpool, Am. British Chemical Co.; 112 cs. cyanide, Liverpool, Order; 20 cs. oxide, Gothenburg, W. F. Eissing; 22 csk. prussiate, Liverpool, Order; 769 bg nitrate, Christiania, Order; 1 cs. peroxide, Havre, C. Hardy, Inc.

STARCH—250 bg., Rotterdam, Stein, Hall & Co.; 250 bg., Rotterdam, Order; 200 bg., Rotterdam, Order.

TALC—200 bg., Genoa, Kountze Bros.

TAR—5 csk., Hamburg, P. & J. Danis; 5 csk., Hamburg, White Sea & Baltic Co.

TARTAR—464 bg., Buenos Aires, Royal Baking Powder Co.; 216 bg., Marseilles, Harshaw, Fuller & Goodwin.

VALONEA—7,156 bg., Smyrna, Order; 3,014 bg., Smyrna, Order.

VARNISH—22 cs., London, American Express Co.

WAXES—320 bg. mineral, Hamburg, Equitable Trust Co.; 12 bg. crude beeswax, San Juan, Order; 27 bg. do., Santo Domingo, J. J. Julia & Co.; 2 bg. do., Monte Cristi, W. Schall & Co.; 50 cs. vegetable, Kobe, Order; 10 bg. beeswax, Alexandria, Order; 40 bg. carnauba, Bahia, Bank of London & South America; 247 bg. do., Pernambuco, Order; 100 cs. vegetable, Kobe, Mitsui & Co.; 100 cs. do., Kobe, H. R. Lathrop & Co.; 1,125 bg. montan, Hamburg, Strohmeyer & Arpe; 20 cs. beeswax, St. Nazaire, Order.

WITHERITE — 520 bg., Newcastle-on-Tyne, R. D. Greeff & Co.; 200 tons (in bulk), Newcastle-on-Tyne, Order.

WHITING — 200 bg., Bremen, C. B. Chrystal & Co.; 2,000 bg. Havre, S. L. Libby Corp.

WOOL GREASE—100 bbl., Bremen, Order.

Current Prices in the New York Market

For Chemicals, Oils and Allied Products

Industrial Chemicals

Acetone, drums, works	lb.	$0.16 – $0.16½
Acetic anhydride, 85 %, dr	lb.	.34 – .36
Acid, acetic, 28%, bbl	100 lb.	3.12 – 3.37
Acetic, 56%, bbl	100 lb.	5.85 – 6.10
Acetic, 80%, bbl	100 lb.	8.19 – 8.44
Glacial, 99½%, bbl	100 lb.	11.01 – 11.51
Boric, bbl	lb.	.09 – .09½
Citric, kegs	lb.	.45½– .47
Formic, 85%	lb.	.11½– .12
Gallic, tech	lb.	.45½– .47
Hydrofluoric, 52%, carboys	lb.	.11 – .12
Lactic, 44%, tech., light, bbl	lb.	.12½– .13
22% tech., light, bbl	lb.	.06 – .06½
Muriatic, 18° tanks	100 lb.	.80 – .85
Muriatic, 20°, tanks	100 lb.	.95 – 1.00
Nitric, 36°, carboys	lb.	.04 – .04½
Nitric, 42°, carboys	lb.	.04¾– .05¼
Oleum, 20%, tanks	ton	16.00 – 17.00
Oxalic, crystals, bbl	lb.	.09½– .09¾
Phosphoric, 50% carboys	lb.	.07 – .08
Pyrogallic, resublimed	lb.	1.55 – 1.60
Sulphuric, 60°, tanks	ton	8.00 – 9.00
Sulphuric, 60°, drums	ton	12.00 – 13.00
Sulphuric, 66°, tanks	ton	13.00 – 14.00
Sulphuric, 66°, drums	ton	17.00 – 18.00
Tannic, U.S.P., bbl	lb.	.65 – .70
Tannic, tech., bbl	lb.	.45 – .50
Tartaric, imp., powd., bbl.	lb.	.26½– .28
Tartaric, domestic, bbl	lb.	.29 – .30
Tungstic, per lb	lb.	1.20 – 1.25
Alcohol, butyl, drums, wks	lb.	.27 – .30
Ethyl, 190 p'f. U.S.P., bbl.	gal.	4.84 – .....
Denatured, 190 proof No. 1, special bbl	gal.	.56 – .....
No. 1, 190 proof, special, dr.	gal.	.50 – .....
No. 1, 188 proof, bbl	gal.	.59 – .....
No. 1, 188 proof, dr	gal.	.53 – .....
No. 5, 188 proof, bbl	gal.	.55 – .....
No. 5, 188 proof, dr	gal.	.49 – .....
Alum, ammonia, lump, bbl	lb.	.03½– .04
Potash, lump, bbl	lb.	.02¾– .03½
Chrome, lump, potash, bbl.	lb.	.05½– .06
Aluminum sulphate, com., bags	100 lb.	1.35 – 1.40
Iron free, bags	lb.	2.35 – 2.45
Aqua ammonia, 26°, drums	lb.	.06½– .06¾
Ammonia, anhydrous, cyl	lb.	.28 – .30
Ammonium carbonate, powd. tech., casks	lb.	.12½– .12¾
Nitrate, tech., casks	lb.	.09 – .10
Amyl acetate tech., drums	gal.	3.00 – 3.25
Antimony oxide, white, bbl	lb.	.12 – .12½
Arsenic, white, powd., bbl	lb.	.06½– .07
Red, powd., kegs	lb.	.14¾– .15½
Barium carbonate, bbl	ton	55.00 – 57.00
Chloride, bbl	ton	73.00 – 74.00
Dioxide, 88%, drums	lb.	.17½– .18
Nitrate, casks	....	.07½– .08
Blanc fixe, dry, bbl	lb.	.03¾– .04
Bleaching powder, f.o.b. wks., drums	100 lb.	1.90 – .....
Spot N. Y. drums	100 lb.	2.20 – 2.25
Borax, bbl	lb.	.05 – .05½
Bromine, cases	lb.	.34 – .38
Calcium acetate, bags	100 lb.	3.00 – 3.05
Arsenate, dr	lb.	.08 – .09
Carbide, drums	lb.	.05 – .05½
Chloride, fused, dr. wks	ton	21.00 – .....
Gran. drums works	ton	27.00 – .....
Phosphate, mono, bbl	lb.	.06¾– .07½
Carbon bisulphide, drums	lb.	.06 – .06½
Tetrachloride, drums	lb.	.06½– .07
Chalk, precip.—domestic, light, bbl	lb.	.04½– .04½
Imported, light, bbl	lb.	.04½– .05
Chlorine, liquid, tanks, wks	lb.	.04½– .....
Contract, tanks, wks	lb.	.04½– .....
Cylinders, 100 lb., wks	lb.	.05½– .07½
Cobalt, oxide, bbl	lb.	2.10 – 2.25
Copperas, bulk, f.o.b. wks	ton	15.00 – 16.00
Copper carbonate, bbl	lb.	.17 – .17½
Cyanide, drums	lb.	.49 – .50
Oxide, kegs	lb.	.16 – .16½
Sulphate, dom., bbl	100 lb.	4.45 – 4.75
Imp. bbl	100 lb.	4.37½– 4.50
Cream of tartar, bbl	lb.	.20½– .21
Epsom salt, dom., bbl	100 lb.	1.75 – 2.00
Imp., tech., bags	100 lb.	1.35 – 1.40
U.S.P., dom., bbl	100 lb.	2.10 – 2.35
Ether, U.S.P., dr. concent'd	lb.	.13 – .14
Ethyl acetate, 85%, drums	gal.	.92 – .95
Acetate, 99%, dr	gal.	1.08 – 1.10
Formaldehyde, 40%, bbl	lb.	.09 – .09½
Fullers earth—f.o.b. mines	ton	7.50 – 18.00
Furfural, works, bbl	lb.	.25 – .....
Fusel oil, ref., drums	gal.	3.50 – 4.00
Crude, drums	gal.	2.75 – 3.00
Glaubers salt, wks., bags	100 lb.	1.20 – 1.40
Imp., bags	100 lb.	.90 – .92
Glycerine, c. p., drums extra.	lb.	.19 – .19½
Crude 80%, loose	lb.	.12½– .12¾
Hexamethylene, drums	lb.	.65 – .70

THESE prices are first-hand quotations in the New York market for industrial chemicals, coal-tar products and related materials used in the industries that produce

Dyes	**Paper and Pulp**
Paint and Varnish	**Petroleum**
Ceramic Materials	**Soap**
Fertilizers	**Explosives**
Rubber	**Food Products**
Sugar	**Metal Products**

Whenever available these prices are those of the American manufacturer. If for material f.o.b. works or on a contract basis, quotations are so designated. All prices refer to large quantities in original packages.

Lead:		
White basic carbonate, dry, casks	lb.	$0.10 – .....
White, basic sulphate, casks	lb.	.09½– .....
White, in oil, kegs	lb.	.11¾– .....
Red, dry, casks	lb.	.11 – .....
Red, in oil, kegs	lb.	.13½– .13¾
Acetate, white crys., bbl	lb.	.14½– .....
Brown, broken, casks	lb.	.13½– .....
Arsenate, white crys., bbl.	lb.	.16 – .18
Lime-Hydrated, b.g., wks	ton	10.50 – 12.50
Bbl., wks	ton	18.00 – 19.00
Lump, bbl	280 lb.	3.63 – 3.65
Litharge, comm., casks	lb.	.10½– .....
Lithopone, bags	lb.	.06 – .06½
Magnesium carb., tech., bags	lb.	.08½– .08¾
Methanol, 95%, bbl	gal.	.74 – .76
97%, bbl	gal.	.76 – .79
Pure, tanks	gal.	.76 – .....
drums	gal.	.78 – .80
bbl	gal.	.83 – .85
Methyl-acetone, t'ks	gal.	.70 – .....
Nickel salt, double, bbl	lb.	.09 – .10½
Single, bbl	lb.	.10 – .11
Orange mineral, csk	lb.	.14 – .14½
Phosgene	...	.60 – .75
Phosphorus, red, cases	lb.	.70 – .75
Yellow, cases	lb.	.37½– .40
Potassium bichromate, casks.	lb.	.08½– .08¾
Bromide, gran., bbl	lb.	.32 – .38
Carbonate, 80-85%, calcined, casks	lb.	.05 – .06½
Chlorate, powd	lb.	.06½– .08½
Cyanide, drums	lb.	.47 – .52
First sorts, cask	lb.	.08½– .08¾
Hydroxide (caustic potash) drums	lb.	.07 – .....
Iodide, cases	lb.	3.65 – 3.75
Nitrate, bbl	lb.	.06 – .07½
Permanganate, drums	lb.	.13 – .13½
Prussiate, red, casks	lb.	.37 – .38
Prussiate, yellow, casks	lb.	.17 – .17½
Salammoniac, white, gran., casks, imported	lb.	.06½– .06¾
White, gran., bbl., domestic	lb.	.07½– .08
Gray, gran., casks	lb.	.08 – .09
Salsoda, bbl	100 lb.	1.20 – 1.40
Salt cake (bulk) works	ton	17.00 – 18.00
Soda ash, light 58% flat, bulk, contract	100 lb.	1.25 – .....
bags, contract	100 lb.	1.38 – .....
Dense, bulk, contract, basis 58%	100 lb.	1.35 – .....
bags, contract	100 lb.	1.45 – .....
Soda, caustic, 76%, solid, drums contract	100 lb.	3.10 – .....
Caustic, ground and flake, contracts, dr.	100 lb.	3.50 – 3.85
Caustic, solid, 76% f.a.s. N. Y.	100 lb.	2.85 – 3.05
Sodium acetate, works, bbl	lb.	.04½– .05
Bicarbonate, bulk	100 lb.	1.75 – .....
Bichromate, casks	lb.	.06½– .07
Bisulphate (niter cake)	ton	6.00 – 7.00
Bisulphite, powd., U.S.P., bbl	lb.	.04½– .04¾
Chlorate, kegs	lb.	.06½– .06¾
Chloride	long ton	12.00 – 13.00
Cyanide, cases	lb.	.19 – .22
Flouride, bbl	lb.	.08½– .09½
Hyposulphite, bbl	lb.	.02½– .02¾
Nitrite, casks	lb.	.09 – .09½
Peroxide, powd., cases	lb.	.23 – .27
Phosphate, dibasic, bbl	lb.	.03½– .03¾
Prussiate, yel. bbl	lb.	.09½– .09¾
Salicylate, drums	lb.	$0.38 – $0.40
Silicate (40°, drums)	100 lb.	.75 – 1.16
Silicate (60°, drums)	100 lb.	1.75 – 2.00
Sulphide, fused, 60-62%, drums	lb.	.02¾– .03¼
Sulphite, crys., bbl	lb.	.02 – .02½
Strontium nitrate, powd., bbl	lb.	.09 – .09½
Sulphur chloride, yel drums	lb.	.04½– .05
Crude	ton	18.00 – 20.00
At mine, bulk	ton	16.00 – 18.00
Flour, bag	100 lb.	2.25 – 2.35
Dioxide, liquid, cyl	lb.	.08 – .08½
Tin bichloride, bbl	lb.	.13¾– .....
Oxide, bbl	lb.	.52 – .....
Crystals, bbl	lb.	.35 – .....
Zinc carbonate, bags	lb.	.12 – .14
Chloride, gran., bbl	lb.	.06 – .07½
Cyanide, drums	lb.	.40 – .41
Dust bbl.	lb.	.08 – .08½
Oxide, lead free, bag	lb.	.07¾– .....
5% lead sulphate bags	lb.	.06¾– .....
French, red seal, bags	lb.	.09¾– .....
French, green seal, bags.	lb.	.10¾– .....
French, white seal, bbl	lb.	.11¾– .....
Sulphate, bbl	100 lb.	3.00 – 3.25

Coal-Tar Products

Alpha-naphthol, crude, bbl	lb.	$0.62 – $0.65
Alpha-naphthol, ref., bbl	lb.	.65 – .75
Alpha-naphthylamine, bbl	lb.	.35 – .36
Aniline oil, drums	lb.	.16 – .16½
Aniline salt, bbl	lb.	.19 – .21
Anthracene, 80%, drums	lb.	.70 – .75
Anthraquinone, 25%, drums.	lb.	.75 – .80
Benzaldehyde U.S.P., tech., drums	lb.	.68 – .72
Benzene, pure, tanks, works.	gal.	.25 – .....
Benzene, 90%, tanks, works	gal.	.23 – .....
Benzidine base, bbl	lb.	.78 – .80
Benzyl chloride, ref. carboys.	lb.	.35 – .....
Benzyl chloride, tech., drums.	lb.	.25 – .....
Beta-naphthol, tech., bbl	lb.	.24 – .25
Beta-naphthylamine, tech	lb.	.65 – .70
Cresylic acid, 97%, drums	gal.	.63 – .65
95-97%, drums, works	gal.	.58 – .60
Dichlorbenzene, drums	lb.	.07 – .08
Dinitrobenzene, bbl	lb.	.15 – .17
Dinitrochlorbenzene, bbl	lb.	.21 – .22
Dinitrophenol, bbl	lb.	.35 – .40
Dinitrotoluen, bbl	lb.	.18 – .20
Dip oil, 25%, drums	gal.	.26 – .28
H-acid, bbl	lb.	.72 – .75
Meta-phenylenediamine, bbl.	lb.	.90 – .95
Monochlorbenzene, drums	lb.	.08 – .10
Naphthalene, flake, bbl	lb.	.04½– .05
Naphthionate of soda, bbl	lb.	.60 – .65
Naphthionic acid, crude, bbl.	lb.	.60 – .62½
Nitrobenzene, drums	lb.	.09 – .09
Nitro-naphthalene, bbl	lb.	.25 – .27
Nitro-toluene, drums	lb.	.13½– .14
N-W acid, bbl	lb.	1.00 – 1.05
Ortho-amidophenol, kegs	lb.	2.40 – 2.50
Ortho-dichlorbenzene, drums	lb.	.10 – .11
Ortho-toluidine, bbl	lb.	.14 – .16
Para-aminophenol, base, kegs	lb.	1.15 – 1.20
Para-dichlorbenzene, bbl	lb.	.17 – .20
Para-nitraniline, bbl	lb.	.68 – .70
Para-nitrotoluene, bbl	lb.	.50 – .55
Para-phenylendiamine, bbl	lb.	1.35 – 1.45
Para-toluidine, bbl	lb.	.75 – .80
Phenol, U.S.P., dr	lb.	.24 – .26
Picric acid, bbl	lb.	.20 – .22
Pitch, tanks, works	ton	27.00 – 30.00
Pyridine, imp., drums	gal.	4.25 – 4.50
Resorcinol, tech., kegs	lb.	1.30 – 1.40
Resorcinol, pure, kegs	lb.	2.00 – 2.25
R-salt, bbl	lb.	.50 – .55
Salicylic acid, tech., bbl	lb.	.32 – .33
Salicylic acid, U.S.P., bbl	lb.	.35 – .....
Solvent naphtha, water-white, tanks	gal.	.24 – .25
Crude, tanks	gal.	.21 – .22
Sulphanilic acid, crude, bbl	lb.	.16 – .18
Tolidine, bbl	lb.	1.00 – 1.05
Toluidine, mixed, kegs	lb.	.30 – .35
Toluene, tank cars, works	gal.	.26 – .....
Toluene, drums, works	gal.	.31 – .....
Xylidine, drums	lb.	.40 – .42
Xylene, 5 deg.-tanks	gal.	.38 – .40
Xylene, com., tanks	gal.	.25 – .27

Naval Stores

Rosin B-D, bbl	280 lb.	$6.25 – $6.35
Rosin E-I, bbl	280 lb.	6.35 – 6.45
Rosin K-N, bbl	280 lb.	6.45 – 6.55
Rosin W.G.-W.W., bbl	280 lb.	7.60 – 8.00
Turpentine, spirits of, bbl	gal.	.88 – .....
Wood, steam dist., bbl	gal.	.74 – .75
Wood, dest. dist., bbl	gal.	.55 – .56
Pine tar pitch, bbl	200 lb.	5.50 – .....
Tar, kiln burned, bbl	500 lb.	10.50 – .....
Rosin oil, first run, bbl	gal.	.40 – .....
Pine tar oil, com'l	gal.	.30 – .....

Animal Oils and Fats

Degras, bbl	lb.	$0.03¾ – $0.05¼
Grease, yellow, loose	lb.	.07½ – .07¾
Lard oil, Extra No. 1, bbl	gal.	.84 – .85
Lard compound, bbl	lb.	.13½ – .13¾
Neatsfootoil, 20 deg. bbl	gal.	1.30 – .....
Oleo Stearine	...	.11½ – .12
Oleo oil, No. 1, bbl	lb.	.18½ – .....
Red oil, distilled, d.p. bbl	lb.	.09½ – .09¾
Tallow, extra, loose works	lb.	.08½ – .08¾
Tallow oil, acidless, bbl	gal.	.84 – .86

Vegetable Oils

Castor oil, No. 3, bbl	lb.	$0.16½ – $0.06¾
Castor oil, No. 1, bbl	lb.	.16½ – .17
Chinawood oil, bbl	lb.	.16½ – .17
Coconut oil, Ceylon, bbl	lb.	.10¼ – .10½
Ceylon, tanks, N. Y	lb.	.09¾ – .09⅞
Corn oil, crude, bbl	lb.	.11½ – .11¾
Crude, tanks, (f.o.b. mill)	lb.	.09½ – ...09¾
Cottonseed oil, crude (f.o.b. mill), tanks	lb.	.09 – .....
Summer yellow, bbl	lb.	.11 – .11½
Linseed oil, raw, car lots, bbl.	gal.	.98 – 1.00
Raw, tank cars (dom.)	gal.	.92 – .....
Boiled, cars, bbl. (dom.)	gal.	1.00 – .....
Olive oil, denatured, bbl	gal.	1.18 – 1.22
Sulphur, (foots) bbl	lb.	.09½ – .09¾
Palm, Lagos, casks	lb.	.08½ – .08¾
Niger, casks	lb.	.08 – .08¼
Palm kernel, bbl	lb.	.09¾ – .....
Peanut oil, crude, tanks (mill)	lb.	.12½ – .....
Refined, bbl	lb.	.16 – .16½
Perilla, bbl	lb.	.14 – .14½
Rapeseed oil, refined, bbl	gal.	.93 – .95
Sesame, bbl	lb.	.13 – .13½
Soya bean (Manchurian), bbl	lb.	.12 – .12½
Tank, f.o.b. Pacific Coast	lb.	.10¾ – .10⅞

Fish Oils

Cod, Newfoundland, bbl	gal.	$0.63 – $0.65
Menhaden, light pressed, bbl.	gal.	.64 – .....
White bleached, bbl	gal.	.66 – .....
Crude, tanks (f.o.b. factory)	gal.	.50 – .....
Whale No. 1 crude, tanks, coast	lb.	..... – .....
Winter, natural, bbl	gal.	.75 – .76
Winter, bleached, bbl	gal.	.78 – .79

Dye & Tanning Materials

Albumen, blood, bbl	lb.	$0.50 – $0.55
Albumen, egg, tech, kegs	lb.	.95 – .97
Cochineal, bags	lb.	.33 – .35
Cutch, Borneo, bales	lb.	.04½ – .04¾
Rangoon, bales	lb.	.13½ – .14½
Dextrine, corn, bags 100	lb.	4.32 – 4.75
Gum, bags 100	lb.	4.82 – 5.09
Divi-divi, bags	ton	41.00 – 42.00
Fustic, sticks	ton	30.00 – 35.00
Chips, bags	lb.	.04 – .05
Gambier com., bags	lb.	.14 – .14½
Logwood, sticks	ton	25.00 – 26.00
Chips, bags	lb.	.02½ – .03
Sumac, leaves, Sicily, bags	ton	165 00 – 170.00
Domestic, bags	ton	50.00 – 55.00
Starch, corn, bags 100	lb.	3.87 – 4.08

Extracts

Archil, conc., bbl	lb.	$0.16 – $0.19
Chestnut, 25% tannin, tanks.	lb.	.01½ – .02½
Divi-divi, 25% tannin, bbl	lb.	.05 – .05
Fustic, liquid, 42°, bbl	lb.	.08 – .09½
Gambier, liq., 25% tannin, bbl.	lb.	.11 – .11
Hematine crys., bbl	lb.	.14 – .18
Hemlock, 25% tannin, bbl	lb.	.03½ – .04
Hypernic, liquid, 51°, bbl	lb.	.12 – .13
Logwood, crys., bbl.	lb.	.14 – .15
Liq., 51°, bbl	lb.	.07½ – .08½
Osage Orange, 51°, liquid, bbl.	lb.	.07 – .08
Quebracho, solid, 65% tannin, bbl	lb.	.04½ – .04¾
Sumac, dom., 51°, bbl	lb.	.06¼ – .06¾

Dry Colors

Blacks–Carbongas, bags, f.o.b. works, contract	lb.	$0.09 – $0.11
spot, cases	lb.	.12 – .16
Lampblack, bbl	lb.	.12 – .40
Mineral, bulk	ton	35.00 – 45.00
Blues–Prussian, bbl	lb.	.37 – .38
Ultramarine, bbl	lb.	.07 – .35
Browns, Sienna, Ital., bbl	lb.	.05 – .12
Sienna, Domestic, bbl	lb.	.03 – .03½
Umber, Turkey, bbl	lb.	.04 – .04½
Greens-Chrome, C.P.Light, bbl	lb.	.28 – .30
Chrome, commercial, bbl.	lb.	.10½ – .11½
Paris, bulk	lb.	.24 – .26
Reds, Carmine No. 40, tins	lb.	4.25 – 4.50
Iron oxide red, casks	lb.	.08 – .12
Para toner, kegs	lb.	.95 – 1.00
Vermilion, English, bbl	lb.	1.30 – 1.35
Yellow, Chrome, C.P. bbls	lb.	.17 – .17½
Ocher, French, casks	lb.	.02 – .03

Waxes

Beeswax, crude, Afr. bg	lb.	$0.27 – $0 28
Refined, light, bags	lb.	.32 – .34
Candellila, bags	lb.	.26 – .27
Carnauba, No. 1, bags	lb.	.34 – .36
No. 2, North Country, bags	lb.	.26 – .27
No. 3, North Country, bags	lb.	.23 – .24
Japan, cases	lb.	$0.16½ – $0.17
Montan, crude, bags	lb.	.06 – .06½
Paraffine, crude, match, 105-110 m.p., bbl	lb.	.06½ – .06¾
Crude, scale 124-126 m.p. bags	lb.	.05½ – .05¾
Ref., 118-120 m.p. bags	lb.	.05¾ – .06
Ref., 123-125 m.p., bags	lb.	.06 – .06½
Stearic acid, sgle. pressed, bags	lb.	.11 – .11½
Double pressed, bags	lb.	.11½ – .12

Fertilizers

Acid phosphate, 16% wks.	ton	$7.50 – $7.75
Ammonium sulphate, bulk f.o.b. works 100	lb.	2.75 – .....
Blood, dried, bulk	unit	4.10 – 4.15
Bone, raw, 3 and 50, ground.	ton	26.00 – 28.00
Fish scrap, dom., dried, wks.	unit	4.50 – .....
Nitrate of soda, bags 100	lb.	2.42½ – .....
Tankage, high grade, f.o.b. Chicago	unit	2.60 – 3.00
Phosphate rock, f.o.b. mines Florida pebble, 68-72%	ton	3.25 – 3.70
Tennessee, 75%	ton	6.75 – 7.00
Potassium muriate, 80%, bags	ton	34.55 – .....
Sulphate, bags, 90%	ton	45.85 – .....
Double manure salt, bgs	ton	26.35 – .....
Kainit, 14%, bgs	ton	10.25 – .....

Crude Rubber

Para—Upriver fine	lb.	$0.29 – .....
Upriver coarse	lb.	.19 – .....
Plantation—First latex crepe	lb.	.29½ – .....
Ribbed smoked sheets	lb.	.29 – .....

Gums

Copal, Congo, amber, bags	lb.	$0.08 – $0.10
East Indian, bold, bags	lb.	.13 – .14
Manila, amber, bags	lb.	.14 – .16
Damar, Batavia, cases	lb.	.24½ – .25
Singapore, No. 1, cases	lb.	.27 – .28
Singapore, No. 2, cases	lb.	.18 – .18½
Kauri, No. 1, cases	lb.	.58 – .64
Ordinary chips, cases	lb.	.21 – .22
Manjak, Barbados, bags	lb.	.06 – .09

Shellac

Shellac, orange fine, bags	lb.	$0.64 – $0.65
Orange superfine, bags	lb.	.65 – .66
Bleached, bonedry	lb.	.73 – .74
T. N., bags	lb.	.62 – .....

Miscellaneous Materials

Asbestos, crude No. 1 f.o.b., Quebec	sh. ton	$300.00–$350.00
Shingle, f.o.b., Quebec	sh. ton	50.00 – 60.00
Cement, f.o.b., Quebec	sh. ton	15.00 – 20.00
Barytes, grd., white, f.o.b. mills, bbl	net ton	17.00 – 17.50
Grd., off-color, f.o.b., Balt	net ton	13.00 – 14.00
Floated, f.o.b., St. Louis, bbl	net ton	23.00 – 24.00
Crude f.o.b. mines, bulk	net ton	8.00 – 9.00
Casein, bbl., tech	lb	.10½ – .12
China clay (kaolin) crude, No. 1, f.o.b. Ga	net ton	7.00 – 8.00
Powd., f.o.b. Ga	net ton	14.00 – 20.00
Crude, f.o.b. Va	net ton	6.00 – 8.00
Ground, f.o.b. Va	net ton	13.00 – 19.00
Imp., powd	net ton	45.00 – 50.00
Feldspar, No. 1 f.o.b. N.C.	long ton	6.50 – 7.25
No. 2 f.o.b. N.C.	long ton	4.50 – 5.00
No. 1 gr'd. N.C.	long ton	15.32 – 21.00
No. 1 Canadian, f.o.b., mill, powd	long ton	20.00 – .....
Graphite, Ceylon, lump, first quality, bbl.	lb.	.05½ – .06
High grade amorphous crude	ton	15.00 – 35.00
Gum arabic, amber, sorts, bags	lb.	.12 – .12
Tragacanth, sorts, bags	lb.	.50 – .55
No. 1, bags	lb.	1.20 – .....
Kieselguhr, f.o.b. Cal	ton	40.00 – 42.00
F.o.b. N.Y.	ton	50.00 – 55.00
Magnesite, calcined, f.o.b. Cal.	ton	35.00 – 45.00
Pumice stone, imp., casks	lb.	.03 – .40
Dom., lump, bbl	lb.	.06 – .08
Dom., ground, bbl	lb.	.03 – .05
Silica, glass sand, f.o.b. Ind.	ton	2.00 – 2.25
Sand blast, f.o.b. Ind	ton	2.25 – 3.50
Amorphous, 200-mesh, f.o.b. Ill	ton	20.00 – .....
Glass sand, f.o.b. Ill	ton	2.00 – 2.50
Soapstone, coarse, f.o.b., Vt., bags	ton	7.50 – 8.00
Talc. 200 mesh, f.o.b., Vt., bags, extra	ton	10.50 – .....
200 mesh, f.o.b., Ga	ton	9.50 – 10.00
325 mesh, f.o.b. New York, grade A	ton	14.75 – .....

Mineral Oils

Crude, at Wells

Pennsylvania	bbl.	$2.50 – $3.00
Corning	bbl.	1.50 – .....
Cabell	bbl.	1.45 – .....
Somerset	bbl.	1.55 – .....
Illinois	bbl.	1.62 – .....
Indiana	bbl.	1.63 – .....
Kansas and Okla. under 28 deg.	bbl.	.85 – .....
California, 35 deg. and up	bbl.	1.40 – .....

Gasoline, Etc.

Motor gasoline steel bbls	gal.	$0.14 – .....
Naphtha, V. M. & P. deod, steel bbls	gal.	.13 – .....
Kerosene, ref. tank wagon	gal.	.13 – .....
Bulk, W.W. delivered, N.Y.	gal.	.08½ – .....
Lubricating oils:		
Cylinder, Penn., filtered	gal.	.29 – .32
Bloomless, 30@31 grav	gal.	.20 – .21
Paraffin, pale 885 vis	gal.	.15½ – .16½
Spindle, 200, pale	gal.	.21 – .21½
Petrolatum, amber, bbls	lb.	.04 – .04½
Paraffine wax (see waxes)		

Refractories

Bauxite brick, 56% Al_2O_3, f.o.b. Pittsburgh	1,000	$140–$145
Chrome brick, f.o.b. Eastern shipping points	ton	45–47
Chrome cement, 40-50% Cr_2O_3	ton	23–27
40-45% Cr_2O_3, sacks, f.o.b. Eastern shipping points	ton	23.00
Fireclay brick, 1st. quality, 9-in. shapes, f.o.b. Ky. wks	1,000	40–43
2nd. quality, 9-in. shapes, f.o.b. wks	1,000	33–37
Magnesite brick, 9-in. straight (f.o.b. wks)	ton	65–68
9-in. arches, wedges and keys	ton	80–85
Silica brick, 9-in. sizes, f.o.b. Chicago district	1,000	48–50
9-in. sizes, f.o.b., Birmingham	1,000	48–50
F.o.b. Mt. Union, Pa	1,000	35–38
Silicon carbide refract brick, 9-in.	1,000	1,180.00

Ferro-Alloys

Ferrotitanium, 15-18% f.o.b. Niagara Falls	ton	$200.00 – ......
Ferrochromium, per lb. of Cr, 1-2% C	lb.	.30 – ......
4-6% C	lb.	.12½ – ......
Ferromanganese, 78-82% Mn, Atlantic seabd. duty paid	gr. ton	95.00 – ......
Spiegeleisen, 19-21% Mn.	gr. ton	33.00 – $35.00
Ferromolybdenum, 50-60% Mo, per lb. Mo	lb.	2.00 – 2.25
Ferrosilicon, 10-12%	gr. ton	39.50 – 43.50
50%	gr. ton	72.00 – 75.00
Ferrotungsten, 70-80% per lb. of W	lb.	.88 – .90
Ferro-uranium, 35-50%, of U, per lb. of U	lb.	4.50 – ......
Ferrovanadium, 30-40%, per lb. of V	lb.	3.25 – 3.75

Ores and Mineral Products

Bauxite, dom. crushed, dried, f.o.b. shipping points	ton	$5.50 – $8.75
Chrome ore, Calif. concentrates, 50% min. Cr_2O_3	ton	22.00 – .....
C.i.f. Atlantic seaboard	ton	18.50 – 24.00
Coke, fdry., f.o.b. ovens	ton	4.00 – 4.50
Coke, furnace, f.o.b. ovens	ton	3.00 – 3.10
Fluorspar, gravel, f.o.b. mines, Illinois	ton	17.50 – 18.50
Ilmenite, 52% TiO_2 Va	lb.	.01½ – .....
Manganese ore, 50% Mn, c.i.f. Atlantic seaport	unit	.41 – .45
Manganese ore, chemical (MnO_2)	ton	75.00 – 80.00
Molybdenite 85% MoS_2, per lb. Mo S_2, N. Y.	lb.	.65 – .70
Monazite, per unit of ThO_2, c.i.f., Atl. seaport	lb.	.06 – .08
Pyrites, Span., fines, c.i.f. Atl. seaport	unit	.11½ – .12
Pyrites, Span., furnace size, c.i.f. Atl. seaport	unit	.12 – .....
Pyrites, dom. fines, f.o.b. mines, Ga	unit	.12 – .....
Rutile, 94@96% TiO_2	lb.	.12 – .15
Tungsten ore, scheelite, 60% WO_3 and over	unit	9.00 – .....
Tungsten, wolframite, white, 60% WO_3	unit	8.50 – 8.75
Uranium ore (carnotite) per lb. of U_3O_8	lb.	3.50 – 3.75
Uranium oxide, 96% per lb. U_3O_8	lb.	12.25 – 12.50
Vanadium pentoxide, 99%	lb.	12.50 – 14.00
Vanadium ore, per lb. V_2O_5	lb.	1.00 – 1.25
Zircon, 99%	lb.	.06 – .07

Non-Ferrous Metals

Copper, electrolytic	lb.	$0.12¾ – $0.13
Aluminum, 98 to 99%	lb.	.27 – .28
Antimony, wholesale, Chinese and Japanese	lb.	.11½ – .11¾
Nickel, 99%	lb.	.27½ – .29
Monel metal, shot and blocks	lb.	.32
Tin, 5-ton lots, Straits	lb.	.49½
Lead, New York, spot	lb.	.08
Zinc, spot, New York	lb.	.06½
Silver (commercial)	oz.	.70
Cadmium	lb.	.60
Bismuth (508 lb. lots)	lb.	1.75–1.85
Cobalt	lb.	2.50–3.00
Magnesium, ingots, 99%	lb.	.90–95
Platinum, refined	oz.	118.00
Mercury 75	lb.	71.00
Tungsten powder	lb.	.95–1.00

Industrial Developments of the Week

New Construction and Machinery Requirements in the Process Industries

Industrial Developments of the Week is a reliable machinery market because every item is reported first-hand by our own correspondents, scattered over the United States and Canada. These leads are verified by our men. We do not use newspaper clippings, nor do we listen to hearsay or rumors. These sales leads are as accurate as our men can make them, and as timely as weekly publication will permit.

This market is for *Chem. & Met.* subscribers. It covers the same equipment fields as does the paper. Here will be found inquiries for machinery for material handling, heating, refrigeration, crushing and grinding, mixing and agitating, screening, filtration, separation, bleaching and dissolving, evaporation, drying and absorption.

Contemplated physical expansion of the process industries during the week ending October 2 amounts to $5,800,000, according to *Chem. & Met.* reports. Essential details are printed on this page.

This free service to all readers will be found here every week. Do not neglect this page of opportunities.

This Week's Opportunities

Fertilizer	Bridgeport, Conn.
Chemical laboratory	Salisbury, Conn.
Gas plant	Springfield, Mass.
Enameling	Cambridge, Mass.
Gas Plant	Portsmouth, N. H.
Candy	Pittsburgh, Pa.
Powder	Bessemer, Ala.
Timber treatment	Edwardsville, Ill.
Gas, etc.	Fort Wayne, Ind.
Dry cleaning	Detroit, Mich.
Rubber	Akron, Ohio
Clay Products	Alliance, Ohio
Chemical	Cleveland, Ohio
Sulphuric acid	Parma, Ohio
Paint and oil	Youngstown, Ohio
Lime and cement	Green Bay, Wis.
Lime	Mayville, Wis.
Gas, etc.	St. Louis, Mo.
Oil refinery	Amarillo, Tex.
Creosoting	Alameda, Calif.
Ceramics	Los Angeles, Calif.
Evaporating	Curries, Ont.
Malt	Guelph, Ont.
Grape products	Jordan, Ont.
Wood preserving	Milton, Ont.
Tannery	Toronto, Ont.
Tannery machinery	Montreal, Que.

New England

Conn., Bridgeport — Berkshire Fertilizer Co., 92 Howard Ave., plans the construction of a 2 story, 100 x 70 ft. factory on Howard Ave., estimated cost $50,000. Private plans.

Conn., Salisbury—The Oxy Crystine Co. is having plans prepared for construction of a 2-story-and-basement chemical-laboratory building, estimated cost $40,000.

Mass., Cambridge—Acme Apparatus Co., 37 Osbourne St., awarded contract for the construction of a 1 and 3 story, 25 x 65 ft., and 35 x 45 ft. boiler house and enameling building, on Osbourne St., estimated cost $40,000. Contractor is C. D. Hall, 689 Massachusetts Ave.

Mass., Springfield—Springfield Gas Light Co., 35 State St., plans to move its plant to Bonci's Island, and build a small pier in the Connecticut River. Estimated cost $500,000 to $800,000. C. H. Tenney, 200 Devonshire St., Boston, is engineer.

N. H., Portsmouth—Portsmouth Gas Co. plans additions to plant on Water St., estimated cost $40,000. Architect not selected.

Middle Atlantic

Pa., Pittsburgh—D. L. Clark Candy Co., Martindale St., awarded contract for the construction of a 5 story and basement, 120 x 150 ft. addition to plant, to D. T. Riffle, 1006 Forbes St., estimated cost $150,000.

South

Ala., Bessemer—Hercules Powder Co., American Trust Bldg., Birmingham, awarded contract for the construction of several buildings for powder plant on outskirts of Bessemer, to cost $500,000, to Bessemer Engineering & Construction Co.

Middle West

Ill., Edwardsville—Western Tie & Timber Co., Syndicate Trust Bldg., St. Louis, Mo., having plans prepared for a tie plant south of Edwardsville. The plant will employ 200 men for treatment of ties and timber. Private plans.

Ind., Fort Wayne—Northern Indiana Gas & Electric Co. has received permit to construct 2 gas holders, byproduct building, screening station, quenching station, generator house, boiler house, and a truck scalehouse. Estimated cost $350,000.

Mich., Detroit — Jacoby's French Dry Cleaners, 10 Custer Ave., is having plans prepared for the construction of a 3-story and basement, 100 x 160 ft. factory for dry cleaning establishment, on Piquette Ave. Estimated cost $100,000. Kohner & Seeler, 405 Kresge Bldg., are architects.

O., Akron—General Tire & Rubber Co., Mr. Jahant, Supt., awarded contract for the construction of a 1-story, 60 x 180 ft. factory, also a 3-story, 40 x 180 ft. factory, to Carmichael Construction Co., 524 Central Savings & Trust Bldg., Estimated cost $100,000.

O., Alliance—Alliance Clay Products Co. plans the construction of a 2 story clay products, face brick and fireproofing plant to adjoin plant No. 2, estimated cost with machinery $250,000.

O., Cleveland—Harshaw, Fuller & Goodwin Co., 545 Hanna Bldg., has plans completed for the construction of two chemical factories, 51 x 164 ft. and 28 x 46 ft., to cost $40,000. Private plans.

O., Parma—Swift & Co., 3237 West 65th St., according to reports current in Cleveland, plan a large sulphuric acid plant as addition to the fertilizer factory.

O., Youngstown—Mahoning Paint & Oil Co. plans the construction of a 2-story plant addition to be completed about Jan. 1. Estimated cost $75,000.

Wis., Green Bay—Western Lime & Cement Co., 68 Wisconsin St., Milwaukee, awarded the contract for the construction of a 2 story and basement, 70 x 68 ft. lime and cement mill, estimated cost $40,000. Jorgensen Construction Co., Denmark, is contractor. Special machinery and lime kiln will be required.

Wis., Mayville — Mayville White Lime Works will soon start work on a 2-story, 52 x 119 ft. lime plant. Estimated cost $40,000. Eckermann & Ruddell, 279 Layton Blvd., Milwaukee, are engineers.

West of Mississippi

Mo., St. Louis—Laclede Gas Light Co., 11th and Olive Sts., having plans prepared for plant and distribution system improvements on Catalan St., consisting of equipment for producer gas plant, new coke screen water softening equipment, apparatus for treating and pumping gas, 30-in. main connecting plant to distribution system, estimated cost $1,137,000; 300,000 cu.ft. relief gas holder, machine for recovery of water gas tar, and miscellaneous appliances at Sta. B. Howard and Main Sts., estimated cost $48,000; 2,000,000-cu.ft. gas holder, two new boilers, pumps, screening and storage machinery, estimated cost $636,000; 42.23 miles of 4-in., 6-in. and 12-in. cast-iron distribution mains, 66.49 miles of service connection pipes, 21,000 gas meters, etc., estimated cost $1,185,000. Private plans.

Tex., Amarillo—J. W. Wrather Oil Co., J. W. Wrather, Pres., will soon receive bids for the construction of a refinery estimated to cost $150,000. Private plans.

Far West

Calif., Alameda — J. H. Baxter & Co., American Bank Bldg., San Francisco, plan the construction of a creosoting plant, lumber and coal yard, estimated cost $250,000.

Calif., Los Angeles—Webber, Staunton & Spaulding, architects, 1017 Hibernian Bldg., are having plans prepared for the construction of a high school to include a ceramics building. Estimated cost $270,000.

Canada

Ont., Curries (Woodstock P. O.)—Curries Evaporating Co. plans to rebuild plant recently destroyed by fire, and will be in the market for new equipment.

Ont., Guelph — The Canadian Dia Malt Co., Ltd., plans to purchase complete mechanical equipment for new plant.

Ont., Jordan—Canadian Grape Products, Ltd., plans to purchase mechanical equipment for new plant.

Ont., Milton—The Milton Wood Impregnating Co., Ltd., c/o Dr. W. D. Cowaso, Regina, Sask., will soon be in the market for complete equipment for a new plant to be erected here for preserving wood and wood products.

Ont., Toronto—Al. R. Clarke & Co., Ltd., 633 Eastern Ave., plans the construction of a 2 story and basement leather tannery on Eastern Ave., in connection with its plant, estimated cost $150,000.

Que., Montreal—A. Beauchamp, 195 St. Andre St., plans to purchase complete tannery machinery and equipment.